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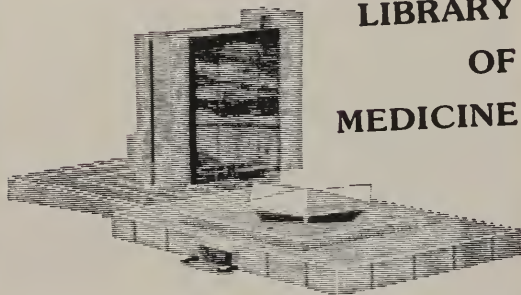
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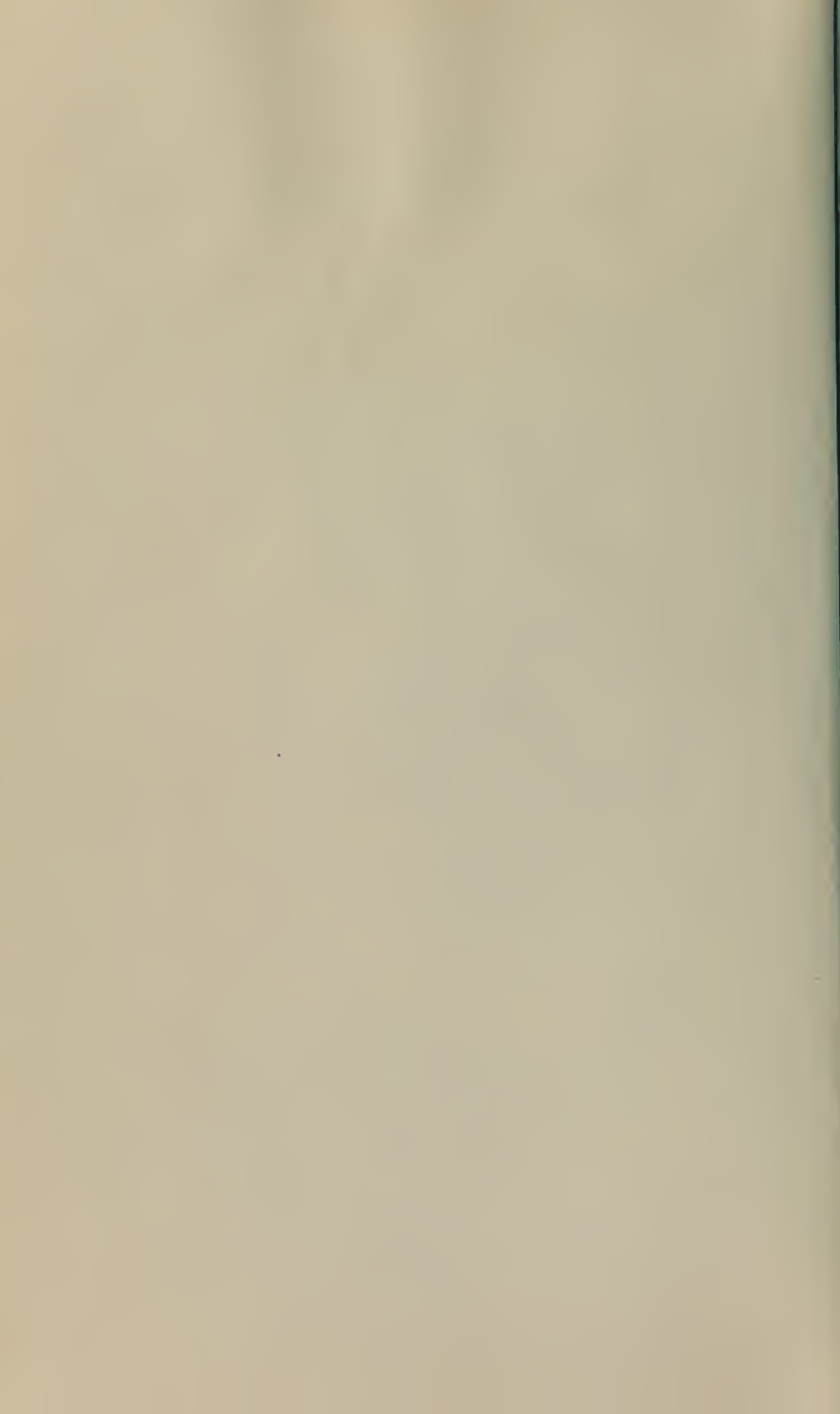
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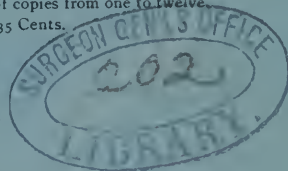
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THE DISEASES OF MEMORY.

BY TH. RIBOT,

AUTHOR OF "HEREDITY," "ENGLISH PSYCHOLOGY," ETC.

TRANSLATED FROM THE FRENCH BY J. FITZGERALD, A. M.

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PREFACE.

My purpose in this work has been to present a psychological monograph of the diseases of memory, and, so far as the state of our knowledge permits, to deduce therefrom a few conclusions. The memory has often been studied, but hardly on its pathological side; and it has seemed to me that it might be profitable to view the subject under that aspect. I have endeavored to restrict myself to that, and have spoken of normal memory only so far as was necessary for clearness.

I have cited many facts, and in this respect my method is not the literary one; but I hold it to be the only one for conveying instruction. To describe in general terms the disordered states of the memory, without giving instances of each, appears to me to be labor thrown away, because it is important that the author's conclusions be capable of verification at every step. I beg the reader to note that what is offered to him here is an essay in descriptive psychology, *i. e.*, a chapter in natural history, and nothing more; and that, if it possesses no other merit, this little volume will acquaint him with a mass of curious observations and cases scattered through all sorts of compilations, and now for the first time collected together.

January, 1881.

T. R

CHAPTER I.

MEMORY AS A BIOLOGICAL FACT.

Memory essentially a biological fact, incidentally a psychic fact—Organic memory—Modifications of nerve-elements; dynamic associations between these elements—Conscious memory—Conditions of consciousness: intensity; duration—Unconscious cerebration—Nerve action is the fundamental condition of memory; consciousness is only an accessory—Localization in the past, or recollection—Mechanism of this operation—It is not a simple and instantaneous act; it consists of the addition of secondary states of consciousness to the principal state of consciousness—Memory is a vision in time—Localization, theoretical and practical—Reference points—Resemblance and difference between localization in the future and in the past—All memory an illusion—Forgetfulness a condition of memory—Return to the starting point: conscious memory tends little by little to become automatic.

The descriptive study of memory has been very well performed by divers authors, especially by the Scotch, and hence it is not designed to revert to it. I propose to inquire what we may learn from the new method of psychology as to the nature of

show that the teachings of psychology combined with those of consciousness lead us to state this problem much more broadly; to prove that memory, as popularly understood, and as usually described by psychologists, so far from being memory in its entirety, is only one particular phase of it, though the highest and most complex, and that this, taken by itself and studied apart, cannot be fully understood; that it is the final term of a long evolution and, as it were, an efflorescence, whose root is found far back in organic life: in short, that memory is essentially a biological fact, and only by accident a fact of psychology.

Thus understood, our study involves a general physiology and psychology of memory, and at the same time its pathology. The disorders and diseases of this faculty, when classified and interpreted, are no longer an assemblage of curious facts and amusing anecdotes to be mentioned only incidentally: on the contrary, they are seen to be subject to certain laws which constitute the very groundwork of memory and which reveal its mechanism.

I.

In the common acceptance of the word, memory includes three things, viz.: the retention of certain states; their reproduction; their localization in the past. This, however, is only one kind of memory, and it may be designated *perfect*. These three elements are of unequal value: the first two are necessary, indispensable; the third, that which, in the language of the schools, is called "recollection," gives completeness to memory, but does not constitute it. Do away with the first two, and memory is abolished: suppress the third, and memory ceases to exist for itself, without ceasing to exist in itself. Hence this third element, which is purely psychological, appears as superadded to the others: they are permanent; it is unstable, appearing and disappearing; it represents what consciousness may claim as its own in the fact of memory, and nothing more.

If we study memory as it has been studied down to our time, as a "faculty of the soul," with the aid of the *sensus intimus* (consciousness) alone, we must of necessity recognize in this perfect and conscious phase all that there is in memory; nevertheless that were, under the influence of a faulty method, to take a part for the whole, or rather the species for the genus. Some authors of our day—Huxley, Clifford, Maudsley, and others,—by maintaining that consciousness is only the accompaniment of some nervous processes, and that it is as incapable of reacting upon them as is a shadow of reacting on the footsteps of the wayfarer that it accompanies, have opened the way for the new theory which is here essayed. Let us set aside for the moment the psychic element, which will

be considered later; let us reduce the problem to its simplest terms, and see how, quite apart from consciousness, a new state is implanted in the organism, how it is retained, and how reproduced: in other words, how, apart from consciousness, a fact of memory has its rise.

Before we come to organic memory itself, we must note certain phenomena that have sometimes been compared to it. Authors have found analogues of memory in the inorganic world, and particularly "in the property possessed by light-vibrations, whereby they may be stored up on a sheet of paper, and there persist, for a longer or shorter time, in the state of latent vibrations, ready to reappear at the summons of a developing agent. Engravings exposed to the sun's rays and then kept in a dark place, can months afterward, by the aid of appropriate reagents, reveal persistent traces of the photographic action of the sun upon their surface."* Lay a key upon a sheet of white paper, and expose the two to the direct rays of the sun; then lay the paper away in a drawer, and years afterward the spectral image of the key will be visible.† In our opinion these and other like facts bear too remote an analogy to memory to merit being cited. In them we find the first condition of all recollection, namely, the retention of the impression, but that is all we find, for here the reproduction of the impression is in such a degree passive, and dependent on the intervention of an outside agency, that it bears no resemblance to the natural reproduction of memory. Furthermore, with regard to the matter before us, we must never forget that we have to do with the laws of life, not with physical laws, and that the foundations of memory must be sought in the properties of organized matter and not elsewhere. It will be seen later that they who overlook this fall into errors.

Neither will I dwell upon certain habits of plants, that have been compared to memory: I hasten to deal with facts of a more decisive character.‡

In the animal kingdom muscle tissue roughly illustrates the acquisition of new properties, their retention and their automatic reproduction. "Daily experience," says Hering, "shows that a muscle becomes stronger the

* Luys, "The Brain and its Functions."

† G. H. Lewes, "Problems of Life and Mind." Third Series, p. 57.

‡ Two facts observed by the Translator may, perhaps, serve to illustrate the persistence of impressions through diversified physical changes. A mass of beeswax that had been employed again and again, melted and re-melted, in an electrolyte foundry; which was all blackened with graphite, and had, apparently, lost forever the cell-structure of the honeycomb, was found to present on its surface, with great distinctness, the outlines of the polygonal cells. Again, a jar of raspberry conserve—the juice of the raspberry boiled, with the addition of sugar, presented the forms of the berries so distinctly that, with care, it was possible to separate one from the mass.

oftener it works. The muscle fiber which at first makes feeble response to the excitation transmitted by the motor nerve, responds more energetically the more frequently it is excited, pauses and rests being of course presupposed. After each action it is more fitted for action again, better prepared for the repetition of the same work, better adjusted for the reproduction of the organic process. It wins more by activity than by long repose. Here we have, in its simplest form,—in that which comes nearest to purely physical conditions—that faculty of reproduction which is found under so complex a form in nerve substance. And what we see in muscular tissue we see in greater or less degree in the substance of the other organs. We everywhere observe that an enhanced functional power of organs accompanies an increase of activity, with sufficient intervals of rest.”*

The most highly developed tissue of the organism, nerve tissue, presents in the highest degree this two-fold property of retention and reproduction. Still, we will not seek in the most simple form of its activity, reflex action, the type of organic memory. Reflex action, indeed, whether it consists of an excitation followed by one contraction or by many, is a result of an anatomical arrangement. And it might be asserted, not without probability, that this anatomical arrangement, now innate in animals, is the product of heredity, that is to say, of a specific memory; that some time it was acquired, and then became fixed and organic through innumerable repetitions. We will not employ this argument in favor of our thesis, for there are many others far less open to question.

The true type of organic memory—and here we come to the very core of our subject—must be sought in that group of phenomena which Hartley so well named *secondary automatic actions*, as opposed to primary or innate automatic acts. These secondary automatic actions, or acquired movements, are the very groundwork of our daily life. Thus, locomotion, which in many lower species is an innate property, in Man has to be acquired—especially that power of coordination which maintains the body's equilibrium at each step we take, by combining tactual impressions with visual. It may be generally affirmed that in an adult the members and the sensorial organs act so freely as they do, only because of the sum of acquired and coordinated movements which constitute for each separate part of the body its special memory—the accumulated capital on which it lives, and by which it acts, just as the mind lives and acts by reason of its past experiences. To the same class belong those groups of movements of a more artificial character, which consti-

tute the apprenticeship of all manual trades, games of skill, various bodily exercises, etc.

If we inquire how these primary automatic movements are acquired, fixed and reproduced, we see that the first step consists in forming associations. The raw material, so to speak, is supplied by the primary reflex actions; these are to be grouped in a certain way, and some combined together, to the exclusion of others. Sometimes this period of formation is simply a long continued experimentation. Acts which now seem to us to be entirely natural, were originally acquired by most laborious effort. When the babe's eyes for the first time see the light, we notice an incoherent fluctuation of movements; a few weeks later coordination of the movements is effected, and the eyes can adjust themselves, can locate a luminous point, and follow its every movement. When a child is learning to write, observes Lewes, he cannot move the hand by itself, but must also move the tongue, the muscles of the face and even those of the feet.* But in time he learns to suppress these useless movements. Any one, on essaying for the first time any muscular act, expends a large amount of superfluous energy, which he afterward by degrees learns to restrict to what is simply necessary. The appropriate motions become fixed by exercise, to the exclusion of the others. There are formed in the nerve elements corresponding to the motor organs, secondary dynamic associations more or less stable (that is to say, a memory), and these are added to the primary and permanent anatomical associations.

If the reader will observe for a moment these secondary automatic actions, which are very numerous and fall under the cognizance of every one, he will see that this organic memory is like psychological memory in all respects, save one, viz., the absence of consciousness. If we sum up the characteristics of organic memory, the perfect resemblance between the two memories will clearly appear:

Acquisition, now instantaneous; again slow. Repetition of the act in some cases necessary, in others of no use. Inequality of organic memory in different persons: in some quick, in others slow or altogether refractory: awkwardness is the result of defective organic memory. In some persons there is permanence of associations that have once been formed: in others these are readily lost, forgotten. Arrangement of these acts in simultaneous or in successive series, just as in the case of conscious memory. A fact worthy of note in this connection is that each member of a series suggests the next following: this is what occurs when we walk without reflecting on the act. Soldiers on foot, and even horsemen in the saddle, overcome by sleep, have been able to keep on the march,

* Hering, “Ueber das Gedächtniss als allgemeine Function der organisirten Materie.” 2e. Auflage. Wien: Gerold's Sohn, 1876, p. 13.

* Op. Cit. p. 51.

though the latter have continually to preserve their equilibrium. This organic suggestion is exhibited more strikingly still in the case mentioned by Dr. Carpenter* of an accomplished pianist, who executed a piece of music while asleep—a feat which we must credit less to the sense of hearing than to the muscular sense which suggested the succession of movements. But not to go in search of extraordinary cases, we find in our daily actions organic series, both complex and well-defined, that is, wherein the beginning and the end are fixed, and wherein the terms, all differing from one another, follow in a constant order, as in going up or down a stairway with which we are familiar. Our psychological memory takes no note of the number of steps; our organic memory notes it after its own fashion, as also the division by landings, the arrangement of the banisters and other details: it makes no mistake. May we not say that, for the organic memory, these well-defined series are strictly the analogues of a phrase, a couplet of verses, or an air in music for the psychological memory.

Thus, then, in its mode of acquiring, preserving and reproducing impressions we find organic memory identical with psychological. Consciousness alone is wanting. At first consciousness accompanied the motor activity, then it gradually disappeared. Sometimes—and such cases are the most instructive—the disappearance of consciousness is abrupt. A certain man subject to temporary suspense of consciousness would continue, while this condition lasted, any movement he might have begun. One day he walked straight into a body of water. Often—for he was a shoemaker—he would prick his fingers with his awl and go on with the movements of stabbing the awl through the leather.† In the epileptic vertigo called the “*petit mal*” such occurrences are of every day observation. A certain musician while playing the violin in an orchestra, was often seized with epileptic vertigo (momentary loss of consciousness) during the performance of a piece—“nevertheless he would keep on playing, and though absolutely unconscious of all around him, neither seeing nor hearing the musicians who accompanied him, he followed the measure.”‡ It is as though consciousness were teaching us just what part it plays, and showing its real value, and by disappearing suddenly, were proving that in the mechanism of memory it is a superadded element.

We have now in logical sequence to advance further, and to inquire what modifications of the organism are required for the establishment of memory, what changes the nervous system undergoes when a group of

movements is definitively organized. Here we come upon the last question that can be raised, without going beyond the region of facts, as to the organic bases of memory; and if organic memory is a property of animal life, whereof psychological memory is only a particular phase, whatever we shall discover or conjecture as to its ultimate conditions, will be applicable to memory in general.

It is impossible for us, in this inquiry, to forego resort to hypothesis. Still, by avoiding all *a priori* conceptions, by keeping close to facts, and taking our stand upon what is known in regard to nerve action, we escape all risk of serious error. Besides, the hypothesis we offer is capable of all sorts of modification. Finally, in lieu of a vague phrase touching the retention and reproduction of memory, it will substitute in our minds a distinct representation of the extremely complex process which produces and sustains it.

The first point to be established is that regarding the seat of memory. This question cannot now-a-days give occasion for any serious controversy. “We must regard it as well nigh demonstrated,” says Bain, “that the renewed feeling occupies the very same parts and in the same manner, as the original feeling.” To cite a striking example of this, experience shows that the persistent idea of a bright color fatigues the optic nerve. We know that the perception of a colored object is often followed by a consecutive sensation which presents the object with the same contours, but in a color complementary to the real color. The same may occur in regard to the idea (the recollection). That, too, leaves, though with a less degree of intensity, a consecutive image. If, with closed eyes, we keep for a length of time an image of very lively colors before the imagination, and then opening the eyes suddenly we fix them upon a white surface, we see thereon for an instant the image contemplated in imagination, but in the complementary color. This fact, as is observed by Wundt, from whom we borrow it, proves that the nerve action is the same in the two cases—in the sense-perception and in the memory.*

The number of facts and inductions that go to confirm this thesis is so great as to make it almost a certitude; and it would require weighty reasons indeed to refute it. In truth there is no such thing as memory but only memories; there is no one seat of memory, but special seats for each memory in particular. Memory is not, as the vague phrase of common speech has it, “in the soul;” it is fixed in its birth-place, in a part of the nervous system.

This premised, we begin to see our way more clearly through the problem of the physiological conditions of memory. These conditions we conceive to be as follows:

* “Mental Physiology,” § 75.

† Carpenter, “Mental Physiology,” p. 75.

‡ Rousseau, “Leçons Cliniques,” vol. II, xli, § 2. In the same passage are found many other facts of this kind. We will return to this subject when we come to treat of the pathology of memory.

* For further details upon this point, see Bain, “The Senses and the Intellect.”

1. A special modification impressed upon the nerve-elements.

2. An association, a special connection established between a certain number of these elements.

Authors have not given to this second condition the importance it deserves, as we shall endeavor to show.

To confine ourselves for a moment to organic memory, let us take one of those secondary automatic movements which have served us as types, and consider what takes place during the period of organization—for instance, the movements of the legs in walking.

Each movement requires the play of a certain number of muscles, superficial or deep-seated; of tendons, joints, ligaments, etc. These modifications—at least most of them—are transmitted to the sensorium. Whatever opinion one may hold upon the anatomical conditions of muscular sensibility, certain it is that it exists; that it tells us what part of the body is concerned in a movement, and that it enables us to regulate this movement.

Now what does this imply? It implies modifications received and retained by a determinate group of nerve-elements. "The movements that are instigated or actuated by a particular nervous center do, like the idea, leave behind them residua, which, after several repetitions, become so completely organized into the nature of the nervous center that the movements may henceforth be automatic."* "The residua of volitions, like the residua of sensations or ideas, remain in the mind and render future volitions of a like kind, more easy and more definite."† It is this organization of the "residua" which, after the period of experimentation already mentioned, enables us to perform movements with more and more ease and precision, till at last they become automatic.

In subjecting to analysis this very familiar instance of organic memory, we see that it implies the two conditions mentioned above.

The first condition is a special modification impressed upon the nerve-elements. As this has oftentimes been explained before, we shall not dwell long upon it. In the first place, the nerve-filament being *ex hypothesi* impressionless, does it, upon receiving an entirely new impression, retain a permanent modification? This is a moot point. Some authors see in the nerves a simple conductor the constituent material of which, being for a moment disturbed by an impression, returns again to its original state of equilibrium. Whether we explain the transmission by vibrations propagated along the axis-cylinder, or by a chemical decomposition of its protoplasm, it is difficult to believe that nothing of it remains. But however that may be, we find at least in the nerve cell the element

which, by general consent, receives, stores up and reacts. Now, an impression, once received, marks it with an imprint. Thereby, according to Maudsley, there is produced an aptitude and with it *differentiation* of the element, though we have no reason to suppose that originally that element differed from homologous nerve cells. "Every impression leaves a certain ineffaceable trace; that is to say, the molecules, once they are arranged otherwise and forced to vibrate in a different way, will not return exactly to their original state. If I brush the surface of still water with a feather, the liquid will not resume the form which it had before: it may again present a smooth surface, but molecules will have changed places, and a sufficiently penetrating eye would certainly discover therein evidence of the passage of the feather. Animal molecules that have been disarranged have thereby gained, in a greater or less degree, aptitude for undergoing disarrangement. Doubtless, if this same external agency does not again act anew upon the same molecules, they will tend to resume their own natural movement; but the case will be very different if they are again and again subjected to the same action. Then they will little by little lose the power of returning to their natural movement, and will become more and more identified with that which is impressed upon them, till at last it becomes natural to them in its turn, and they obey the slightest cause that will set them in vibration."*

It is impossible to define wherein this modification consists. Neither microscope nor reagents, neither histology nor histochemistry can throw light upon it; but facts and reason assure us that it exists.

The second condition, which consists in the establishment of stable associations between different groups of nerve-elements, has not hitherto attracted attention. I am not aware even that contemporary authors have recognized its importance; and yet it is a necessary consequence of their thesis upon the seat of memory.

Some of them appear to hold, implicitly at least, that a memory, either organic or conscious, is impressed upon a single cell which, with its nerve filaments, would seem to possess a sort of monopoly of retaining and reproducing it. What has contributed to keep up this illusion is, I conceive, the fashion of speech which requires us to look on a movement, a perception, a thought, an image, a sentiment, as *one* thing, as a *unit*. But reflection soon shows each of these supposed units to be made up of many and heterogeneous elements; that it is an association, a group, a fusion, a complex, a *multiplicity*. Take the example already cited—a locomotory movement. This may be regarded as a reflex action of great complexity, the initial

* Maudsley, "Physiology and Pathology of the Mind," p. 167.

† *Ibid.*, p. 157.

* Delbœuf, "Théorie Générale de la Sensibilité," p. 60.

impression of which is the contact of the foot with the ground each moment.

Let us consider this movement at first in its complete form. Is the starting point a voluntary act? Then, according to Ferrier, the impulsion that has its rise in a particular region of the cortex of the brain, traverses the white substance, passes into the corpora striata, through the crura cerebri, the protuberance, the complex structure of the medulla; thence going over to the other side of the body, where it descends along the anterolateral columns of the spinal cord to the lumbar region, and thence along the motor nerves to the muscles. This transmission is accompanied or followed by a return to the centers through the posterior columns of the cord and the gray matter, the medulla, the pons Varolii, the optic tract and the white matter to the cortex of the brain. Let us consider this movement in its abridged and most ordinary form—when it is automatic. In that case, according to the commonly received hypothesis, the transit proceeds only from the periphery to the cerebral ganglia and back again to the periphery, the superior brain not being involved in the movement.

This movement, the principal stages of which we have roughly indicated, and all the details of which are not yet thoroughly known, even to the most learned anatomists, implies the calling into action of nerve-elements very numerous, and very diverse. Thus, the motor and the sensory nerves differ in their histological structure from the nerves of the brain and the spinal cord. The cells differ in volume, in form (there being fusiform cells, giant cells, pyramidal cells, etc.), in the directions in which they lie, in the number of their filaments, in their position in the several parts of the cerebro-spinal axis, for they are distributed from the inferior extremity of the spinal cord to the cortical layers. All these elements play their respective parts in the concert of action. If the reader will glance at an anatomical chart, or at a few histological preparations, he will obtain an approximate idea of the enormous number of nerve-elements necessary to produce a movement, and consequently to retain and reproduce it.

We therefore hold it to be of the utmost importance to call attention to this point, viz., that organic memory supposes not only a modification of the nerve elements, but also the *establishment between them of associations adapted to each special action*—of certain *dynamic associations* which, by repetition become as stable as the primary anatomical connections. In our opinion the thing that is of importance, as supplying a basis for memory, is not only the modification impressed upon each element, but the way in which sundry elements are grouped together to form a complex.

As this point is for us of the first importance, we shall have no hesitation in dwelling

upon it. First, it will be observed, that our hypothesis, which is a necessary corollary of admitted facts regarding the seat of memory, simplifies certain difficulties, though at first view it may appear to complicate them. The question is asked, can each nerve cell preserve many different modifications; or, once modified, is it polarized forever after? Of course we are reduced here to conjecture; yet we may without rashness suppose that though it may be capable of many modifications, the number of these must be limited. So, too, we may suppose that it preserves only one. The number of the brain cells being 600,000,000, according to the calculation made by Meynert (and Dr. Lionel Beale gives a very much higher number), the hypothesis of a single impression is in no wise inadmissible. But this question is of secondary interest for us, for even though we accept the latter hypothesis—the most unfavorable one for explaining the number and complexity of acts of organic memory—we should find that this single modification, being capable of entering into different combinations, may produce different results. We are to note not only each factor individually, but the relations of all the factors to one another, and the combinations thence resulting. The modified cell may be compared to a letter of the alphabet. This letter, while it continues to be the same, has concurred in forming millions of words in the living and dead languages. Combinations innumerable and of the highest complexity may result, through grouping, from a small number of elements.

To return to our instance of locomotion: The organic memory that serves as its basis consists of a special modification of a multitude of nerve elements. But several of these elements, thus modified, may subserve another purpose, may enter into other combinations, may take a part in other memories. The secondary automatic movements that constitute swimming or dancing presupposes certain modifications of the muscles, certain articulations already employed for locomotion, already registered in certain nerve elements; in short, they find a memory already organized, sundry elements of which they turn to their own advantage, causing them to enter into a new combination and to concur in forming another memory.

Further, we would observe, that the necessity of a great number of cells and nerve filaments for the retention and reproduction of a movement, though the same be a comparatively simple one, implies a greater possibility of permanence and reviviscence; in consequence of the number of the elements and of the solidarity established between them, the chances of reviviscence are increased, each one tending to call forth the others.

Finally, our hypothesis is in agreement with two facts of daily observation, viz.:

1. An acquired movement that is well fixed

in the organism, firmly *retained*, is displaced only with great difficulty by another, having nearly the same seat, but involving a different mechanism. In fact, one association has to be broken up to form another; established relations have to be annulled to set up new ones.

2. It sometimes happens that, in lieu of one accustomed movement, we involuntarily perform another; this is accounted for by the fact that as the same elements enter into different combinations capable of producing nerve-discharges in different directions, a trifling circumstance may suffice to call into activity one group instead of another, so producing different effects. Thus at least do we explain the following fact, reported by Lewes (Op. Cit., p. 128): "I was one day relating a visit to the Epileptic Hospital, and, intending to name the friend, Dr. Bastian, who accompanied me, I said, 'Dr. Brinton,' then immediately corrected this with 'Dr. Bridges;' this also was rejected, and 'Dr. Bastian' was pronounced. I was under no confusion whatever as to the persons, but, having imperfectly adjusted the group of muscles necessary for the articulation of the one name, the one element which was common to that group and to the others, namely, B, served to recall all three." The explanation seems entirely correct, and we may note with the author another familiar fact which favors our theory: "Who does not know," says Lewes, "how, in trying to recollect a name, we are tormented with the sense of its beginning with a certain letter, and how, by keeping this letter constantly before the mind, at last the whole group emerges." A like observation may be made with regard to the acquired movements that constitute the act of writing. It is a mistake I have often found myself falling into, especially when writing rapidly and with a wearied brain; it is so trifling, so quickly corrected and so quickly forgotten, that I have had to make a note of it at the moment. Here are some instances: Intending to write the words "*doit de bonnes*," I wrote "*donne*." Intending to write "*ne pas faire une part*," I wrote "*ne part faire*," etc. Evidently, in the first case the letter D, and in the second the letter P (and by letter I mean the psycho-physiological state which serves as the basis for their conception and graphic representation), called forth one group instead of another; and this confusion was all the easier as the remainder of the groups, "*onne*" and "*art*," were already in the consciousness. Doubtless any one who will take the trouble of observing his own practice in these respects will admit that such errors are of frequent occurrence.

What has been said is hypothetical, but the hypothesis appears to be in agreement with scientific data, and to account for the facts. It enables us to contemplate in pretty definite shape the bases of organic memory,

of those acquired movements which constitute the memory of our several organs—our eyes, our hands, our members. These bases do not, in our opinion, consist in a purely mechanical registration, nor, as the usual comparison would have it, in an impress preserved we know not where, like the image of the key already mentioned. These are similes borrowed from the world of physics and are out of place here. Memory is a biological fact. A rich and well-stored memory is not a collection of impressions, but an assemblage of dynamic associations, very stable and very readily called forth.

II.

We are now to study a more complex form of memory, that which is accompanied by consciousness, and which in ordinary language, and even in the language of psychologists is regarded as the sum total of memory. We have to inquire how far what has just been said of organic memory applies to this, and what is added by consciousness.

In passing from the simple to the complex, from the lower to the higher, from a stable form of memory to an instable one, we must not overlook the preliminary question of the relation between the unconscious and consciousness. Soinvolved is this problem in its native obscurity and in artificial mysticism, that it seems difficult to say anything clear and decisive about it; but we shall try.

Of course we have nothing to do with the metaphysics of the unconscious, as understood by Hartmann and others; we shall even begin by confessing that we know not how to explain the transition from the unconscious to consciousness. One may offer ingenious, plausible hypotheses upon the subject, but nothing more. However, psychology, as a science of facts does not need to concern itself with these points; it takes consciousness for granted, without caring for its genesis; all that it can do is to determine a few of its conditions of existence.

The first of these is the mode of action of the nervous system, called by physiologists nervous discharge. But most nerve states do not awaken consciousness at all, or but rarely, and in an indirect way: for instance, the excitations and discharges whose seat is the great sympathetic; the normal action of the vaso-motor nerves; a great many reflex actions, etc. Others are accompanied by consciousness intermittently; or, though they are conscious in the early period of life, they cease to be so in the adult; instance the secondary automatic actions already mentioned. Nerve action is far more widely distributed than psychic activity: all psychic acts involve nerve action, but the proposition is not reciprocally true. Between the nerve activity that is never, or hardly ever, accompanied by consciousness, and the nerve activity that is always, or nearly always, so accompanied, stands that which sometimes

has for its concomitant consciousness. It is in this group of facts that the unconscious must be studied.

Before we arrive at clearer and better-grounded conclusions on this subject, we would note two other conditions of consciousness, viz., intensity and duration.

1. Intensity is a condition of highly variable character. Our states of consciousness are ever striving to supplant one another, but victory may result equally either from the superior strength of the victor or from the weakness of the other contestants. We know—and this point has been very well elucidated by the school of Herbart—that the most vivid state of consciousness may grow steadily fainter till at last it falls below the level of consciousness, in other words, till one of its conditions of existence fails. We are justified in affirming for consciousness all possible degrees down to the lowest, to the state called by Maudsley sub-conscious; but there is no warrant for maintaining that this descending scale has no end, though we may not discern it.

2. *Duration*, as a necessary condition of consciousness, has not received much attention; yet it is of the first importance. On this point we can reason from definite data. The researches of the last thirty years have determined the time that is required for the different sense-perceptions, (hearing 0.16 to 0.14 sec., touch, 0.21 to 0.18 sec., sight, 0.20 to 0.22 sec., and for the simplest act of discernment, that nearest to reflex action 0.02 to 0.04 sec.). Though the results vary according to the experimenter, the person under experiment, the circumstances and the nature of the psychical acts that are being investigated, so much is at least established, viz., that every psychical act requires an appreciable duration, and that the supposed infinite rapidity of thought is only a figure of speech. From this it follows that no nervous action, the duration of which is less than that required by psychic action, can awaken consciousness. An instructive comparison may be made between the nervous act accompanied by consciousness, and simple reflex action. According to Exner* the time necessary for a reflex action is 0.0662 to 0.0578 sec., which is much less than that stated above for the different sense-perceptions. If, as Herbert Spencer observes, the wing of a gnat makes from ten to fifteen thousand beats in a second, each involving a separate nervous act, we have nerve action of astounding rapidity, compared with which nervous acts accompanied by consciousness occupy an enormous length of time. From all this it follows that since every act of consciousness necessarily requires

a certain duration, one essential condition of consciousness is wanting whenever the duration of a nervous process falls short of that minimum.*

The question of the unconscious is obscure and beset with contradictory opinions, simply because it is incorrectly stated. If we look on consciousness as an entity, as a fundamental attribute of the soul, all becomes obscure; if we consider it as a phenomenon having its own conditions of existence, all becomes clear, and the unconscious is no longer a mystery. We must never forget that a state of consciousness is a complex fact which supposes a special state of the nervous system; that this nervous action *is not a mere accessory but an integral part* of the fact; that it is its base, its fundamental condition; that given the nervous action the fact exists *in* itself; that, consciousness being added, the fact exists *for* itself; that consciousness completes it, perfects it, but does not constitute it. If one of the conditions of consciousness be wanting, as intensity, or duration, or any other unknown to us, then a part of the complex whole—consciousness—disappears; but another part—the nervous process—remains. All that is left of the fact is its purely organic phase. It is not surprising, therefore, if later the results of this cerebral activity turn up; such activity there was, though it was not noted.

Regarded from this point of view, the whole subject of unconscious action loses its mysterious character, and is readily explained, for example, the sudden in-rush of recollections, apparently called up by no association, that occurs daily to every one; the lessons read by a schoolboy at night, known by heart in the morning; problems long studied, the solution of which bursts suddenly on the consciousness; poetical, scientific, and mechanical inventions; secret sympathies, etc. Unconscious cerebration does its work noiselessly, and reduces obscure ideas to order. In a curious case mentioned by Carpenter,† a

* The researches as to the duration of psychic acts may throw new light upon certain facts of our mental life. Thus they help, I think, to explain the transition from the conscious to the unconscious in habits. An act is at first performed slowly, consciously; by repetition it becomes easier and is executed more rapidly, *i. e.*, the nervous process which is its basis, finding its course fully traced for it, takes place rapidly and by degrees falls below the minimum duration required for consciousness.

† "Mental Physiology," p. 533. The whole chapter xiii contains interesting facts about unconscious cerebration. A mathematician, a friend of the author, had been occupied with a geometrical problem, and had had a glimpse of the solution. He reverted to it again and again without success. Many years afterward the solution occurred to him so suddenly that he "trembled as if in the presence of another being who had communicated the secret." If any one would witness the spectacle of a powerful and penetrating mind hampered by a faulty method, he must read Sir William Hamilton's remarkable study of "Latency," ("Metaphysics," vol. i, lect. xviii). With his theory of the faculties of the soul, and his willful disregard of all physiology, he is unable to escape from any difficulty.

* Pfliiger's "Archiv," viii (1874), p. 526. The duration of reflex actions varies according to the force of the stimulus, and the direction of the transmission, whether longitudinal or transverse, in the spinal cord. But this question is by no means cleared up.

man was vaguely cognizant of the work going on in his brain, without having distinct consciousness. "A business man in Boston having an important question under consideration, had given it up for the time as too much for him. But he was conscious of an action going on in his brain which was so unusual and painful as to excite his apprehensions that he was threatened with palsy, or something of that sort. After some hours of this uneasiness, his perplexity was all at once cleared up by the natural solution of his doubts coming to him—worked out, as he believed in that obscure and troubled interval."

To sum up, we may regard the nervous system as being traversed by continuous discharges. Of these nervous actions some answer to the incessant rhythm of the vital activities; others, much fewer in number, to the succession of states of consciousness; still others, and these are by far more numerous, constitute unconscious cerebration. The six hundred (or the twelve hundred) million cells, and the four thousand or five thousand millions of fibers, even allowing for those which are inactive or remain during the whole period of life without occupation, offer a considerable contingent of active elements. The brain is a sort of busy workshop where ten thousand different operations are going on at once. Unconscious cerebration not being subject to the conditions of time, and taking place so to speak only in space, may act in different places simultaneously. Consciousness is the narrow wicket through which a very small portion of all this work becomes visible to us.

We now see wherein consists the relation of consciousness to the unconscious, and by that very fact we have a definite idea of the relation of psychic to organic memory: the former is only one phase of the latter. In a general sense, what has been said of physiological memory applies to conscious memory: there is simply the addition of one factor. Still it will be of advantage to consider the question anew, and in detail. Here again we have to examine two things, namely the *residua* and the groups they form.

I. The old theories of memory, as they contemplated only its psychological aspects, assigned for its only basis "vestiges," "traces," "*residua*," and often erred in employing these terms in an ambiguous sense, signifying now material impresses on the brain, again latent modifications retained in the "soul." Those who adopted the latter opinion were logical. But this theory, though it numbers many partisans among those who stand aloof from physiology, is untenable. A state of consciousness that is not conscious, a representation that is not represented, is simply a form of speech, and nothing more. To eliminate from a thing that which constitutes it what it is, is to reduce it to a simple possibility; that is to say, when the conditions

in which it exists reappear, the thing will reappear too. And this brings us back to what was said above with regard to the unconscious.

For us, the question of "psychological *residua*" is settled beforehand; for if every state of consciousness implies as an integral part of itself nerve action, and if this nerve action modifies the nerve centers in a permanent way then the state of consciousness too is recorded in those centers. True, it may be objected that a state of consciousness implies nerve action and *something more*. That makes little difference. If the original nervous state—perception—sufficed to call up this something more, the secondary nervous state—recollection—equally suffices. The conditions are the same in the two cases; and the solution of this difficulty, if solution there be, is incumbent on a theory of perception, not on a theory of memory.

We may with Wundt call this psychophysiological residuum an arrangement, and with him point out wherein it differs from an impress. "Certain analogies taken from the domain of physiology bring out this difference clearly. In the eye that has been exposed to intense light the impression received persists in the shape of a consecutive image. The eye which daily compares and measures distances and relative positions in space becomes more and more exact. The consecutive image is an impress: the accommodation of the eye, its power of measuring distances, is a functional arrangement. The retina and the muscles may be formed in the unpracticed eye just as they are in the practiced, but there is in the latter a far more marked anatomical arrangement than in the former. No doubt we may say that physiological use and work of organs depends less upon their changes properly so-called than on the impresses that persist in their nervous centers; but all physiological researches into the phenomena of habit, of adaptation to conditions, etc., show that here too impresses consist essentially of functional arrangements."

II. These considerations bring us to the point upon which we desire to lay stress. The dynamic associations of the nerve elements play a still more important part in conscious memory than in organic memory. We might repeat what has been said above; but this side of the question has been so little studied that it is best to consider it again under another form.

Every one finds in his consciousness a number of recollections: of men, animals, cities, landscapes; facts of science, of history, of language, etc. These recollections recur to us in the shape of series, longer or shorter. The formation of these series has been very well explained by the laws of association between states of consciousness, and to that

* "Grundzüge der Philosophischen Psychologie," p. 791.

explanation we have nothing to add. What interests us is, not the series but the terms of which they are composed. We want to get at the simple state of consciousness, in order to show what complexity it involves.

Let us take then one of these terms—the recollection of an apple, for instance. If we are to believe the dictum of consciousness, this is a very simple fact, but physiology shows this to be an error. The recollection of an apple is necessarily the weakened form of the perception of an apple. What does this perception imply? A modification of the retina, which is the nerve terminus of a highly complex structure; transmission through the optic nerve, and the corpora geniculata to the tubercula quadrigemina; thence to the cerebral ganglia (optic tract?); through the white matter to the cortex. This involves the calling into action of many different elements, lying along an extended route. Yet this is not all. It is not a question of a mere color-sensation. We see, or think we see the apple as a solid object of spherical form. These judgments result from the exquisite muscular sensibility of our visual organ and from its movements. But the movements of the eye are governed by sundry nerves, as the sympathetic, the oculo-motor communis and the oculo-motor externus. Each of these nerves terminates at a particular point in the medulla, which is itself connected with the cortex of the brain where originate what Maudsley calls the motor intuitions. We give only the outlines; for details the reader may consult anatomical and physiological treatises. Thus an idea may be formed of the enormous number of nerve filaments and nerve cells scattered in groups through the different parts of the cerebro-spinal axis, that serve as a basis for the psychic state—the recollection of an apple—by which by the twofold illusion of language and consciousness we are led to regard as so simple.

It will, perhaps, be objected that a visual perception is highly complex, and proves too much in favor of our thesis. Take, then, the recollection of a word. If it be a written word, the recollection is visual, and the case is analogous to the preceding. But if it be a spoken word, the complexity is equally great. Articulate language presupposes the cooperation of the larynx, the pharynx, the mouth, the nasal passages, and consequently of several nerves having their centers in divers parts of the medulla, viz.: the spinal, facial and hypoglossal nerves. And if you assign to auditive impressions a place in the recollection of words, the complexity is still greater. Finally, the medullary center must itself be connected with Broca's convolution and the region of the insula, both of which are universally regarded as the psychic center of speech. It is seen that this case differs neither in kind nor in the degree of its complexity from the preceding, and that the re-

collection of each separate word must have for its basis a definite association of nerve elements.*

There is no need to dwell upon this point: from what has been said we see the importance of those associations which I shall call the *dynamic bases* of memory, the modifications impressed upon the elements being the static bases. It will, perhaps, be said that our examples suppose cases simpler still: true, but we need not concern ourselves with them. What memory preserves and reproduces, is concrete actual states of consciousness; we had, therefore, to regard them as such, and to select instances from that order of facts. Physiological analysis and ideological analysis, descending, each from its own side, to the ultimate elements, are of service in explaining the genesis of states of consciousness: but here we consider them as formed. When we are learning to talk, we employ a few simple words; later, we make use of a few phrases. For a long time we know not that these words imply elements simpler still: many men never know it. Now consciousness, which is an inner speech, acts in the same way: that which for it is simple, analysis shows to be complex. But no doubt the simple states that are the alphabet of consciousness, themselves presuppose, for their retention and their reproduction, certain complexes of nerves. The examples already cited with regard to letters and syllables prove this. A still more curious one is cited by Dr. Forbes Winslow: A well-educated man, after an attack of fever and ague, lost all the knowledge of the letter F.†

Hence if we would portray to ourselves a good memory and translate that expression into the language of physiology, we should have to picture to ourselves a great many nerve elements, each modified in its own way, each taking part in an association, and, perhaps, adapted to enter into many associations, each association comprising the conditions of states of consciousness. The memory thus has static bases and dynamic bases. Its power is in proportion to the number of these and their stability.

III.

We are now to study the special character of the psychic memory, that which is peculiarly its own, and which, while making no change in its nature or its organic conditions, constitutes it the highest, the most complex, and the most instable form of memory. This character is, in the language

* Forbes Winslow, "On the Obscure Diseases of the Brain," 4th edition, p. 257, mentions the case of a soldier who, having undergone the operation of trephining, lost a portion of his brain. Some time afterward it was noticed that he had forgotten the numbers *five* and *seven*, and those only. After a time he recovered his memory of these two numbers.

† *Op. cit.* p. 258. The author does not tell us whether it was the articulation or the graphic sign, or both, nor whether the patient recovered.

of the schools, called recollection. I shall call it Localization in Time, that term implying no hypothesis and being simply the expression of the facts.

There are few questions that the method of "mental faculties" has so perplexed with difficulties and with far-fetched explanations as this. It will, therefore, be well at the outset briefly to indicate how, from our point of view, the question is stated and how it is settled.

Localization in time (for example the recollection that such or such an accident befell us at such a time and in such a place) is not a primary act. It supposes, in addition to the principal state of consciousness, secondary ones varying in number and degree which, being grouped around it, determine it. Perhaps the mechanism of "recollection" is best explained by the mechanism of vision.

The distinction between primary and acquired visual perceptions has been recognized ever since Berkeley's time. We know that the primary datum of the sensation of sight is a colored surface; that the secondary data are direction, distance, form, etc.; that the former is dependent above all on the sensibility of the retina, while the latter depend mainly on the muscular sensibility of the eye; that by force of habit the primary and acquired have become so blended together that they seem to constitute one simple ultimate act, though the opposite is proved by analysis, by experiment and by divers pathological cases. So with regard to memory. The primary state of consciousness is originally given as simply existent: the secondary states of consciousness superadded to it, and which consist of relations and judgments, localize it at a certain distance in time, so that memory may be defined *seeing in time*.

This operation which, for clearness' sake we have thus roughly described, must now be studied more closely and in detail.

The theoretical explanation of localization in time starts from the law formulated by Dugald Stewart, and so well explained by Taine,* that the acts of the imagination are always accompanied by a belief, at least momentary, in the actual existence of the object to which they relate. This belief, which is most pronounced in hallucination, in vertigo and in dreaming (because there are no actual perceptions to correct it) exists, though in a less degree, with respect to all states of consciousness whatever. I say nothing here of the mechanism by which the state of consciousness is stripped of its objective reality and reduced to a simple conception of the mind. On this point I refer the reader to the explanations offered by Taine.†

Still this is not a recollection. So long as an image, whatever it may stand for—a house,

a mechanical invention, or a feeling—remains isolated, and, as it were, suspended in the consciousness, having no relation to other states that for us have a fixed place, and not being localizable by us—we see therein only an actual state of consciousness. But among such images there are some that possess the property, so soon as they enter the consciousness, of ramifying in different directions, of reawakening states of consciousness that connect them with the present, and thus they occur to us as forming a part of a longer or shorter series terminating in the present. In other words, they are localized in time.

I shall not inquire whether it is memory that makes the idea of time possible, or whether it is the idea of time that makes memory possible; neither shall I discuss the question whether time be an *a priori* form of the mind, nor whether memory be explicable by an empiric genesis. These questions have a place in a critique of knowledge, not in an empiric psychology, which has nothing to do with these critical or ontological discussions; it ascertains as a fact that time implies memory, and that memory implies time, and is content. This conceded, how do we localize in time?

Theoretically, only one course is open to us. We determine positions in time, as we do positions in space, by referring to a fixed point, and as regards time, this fixed point is the present moment. We may observe that this present moment is a real state, having its duration-quantity. Brief as it is, it is not, as the metaphors of ordinary language would have it, a flash, a nothing, an abstraction, like a mathematical point: it has a beginning and an ending. Further, its beginning does not appear to us as an absolute beginning: it is in contact with something with which it is continuous. When we read or hear a sentence, there remains at the utterance of the fifth word, for example, something of the fourth. Each state of consciousness is effaced only by degrees; it leaves a trail like what, in physiological optics, is called the consecutive image (after-sensation, *Nachempfindung*). Thus, then, the fourth and the fifth words are continuous—the end of one being in contact with the beginning of the other. This is the main point. There is a contiguity, not indefinite, meaning that *any* two ends are in contact, but such a contiguity that the *beginning* of the actual state of consciousness is in contact with the *ending* of the state that preceded it. This simple fact once clearly apprehended, we have the *theoretical* mechanism of localization in time, for it is plain that the retrograde movement may also be made from the fourth word to the third, and so on; and that each state of consciousness having its own duration-quantity, the number of states of consciousness thus traversed regressively, and their duration-quantities give the position of any given state relatively to the present

* "On Intelligence." In this work will be found a collection of facts which leave no doubt on this point.

† Op. Cit., particularly Part II, Book 1, ch. ii.

moment—its distance in time. Such is the theoretical mechanism of localization; a retrogression which, starting from the present, traverses a longer or shorter series of terms.

Practically, we have recourse to simpler and more expeditious processes. We very rarely perform this retrogression through all of the intermediate terms of the series, seldom even through the greater part of them. We simplify the operation by the employment of reference points.

I take a familiar example to illustrate: On the 30th of November I am expecting a book I greatly need. It comes from a distance, and cannot arrive in less than twenty days from the time of ordering it. Did I order it early enough? After trying in many ways to fix the date, I remember that I ordered the book on the day before I set out on a little journey, and the date of that I can determine precisely as Sunday, November 9th. The recollection is now perfect. If we analyze this case, we shall see that the principal state of consciousness—ordering the book—was at first something referred indefinitely to the past. It calls up secondary states, and compared with these, it is seen to precede some, to be subsequent to others. "The image," says Taine, "glides to and fro on the line of the past; each of the phrases pronounced mentally has given it a new oscillation."* At last it finds its place; it is now fixed, known. In this illustration the recollection of the journey is what I call a reference point. By reference point I mean any occurrence, any state of consciousness whose position in time we know, *i. e.*, its distance with respect to the present moment, and which serves as a measure of other distances in time. These reference points are states of consciousness which, from their intensity, withstand oblivion better than others, or which from their complexity are adapted to call up many associations and to increase the chances of reviviscence. They are not selected arbitrarily, but force themselves upon us. Their value is purely relative. They retain this character for a day, a week, a month; but then, not coming into use, they are forgotten. As a rule they are purely individual in character, though some of them are common to a family, to a small community, to a nation. If I am not mistaken, they constitute for each individual different series answering pretty closely to the different occurrences that make up his life—his daily occupations, family events, professional occupations, scientific researches, etc., these series being more numerous in proportion as the life of the individual is more diversified. These reference points are like milestones set up on highways which, starting from one point diverge in various directions. But they possess this peculiarity,

that these series may, as it were, come into juxtaposition so as to be compared.

We have now to show how these reference points enable us to simplify the mechanism of localization. The event, which we call a reference point since, according to the hypothesis, it comes very often into consciousness, is very often compared to the present as regards its position in time—in other words, the states intermediate between the two and separating them, are called up with greater or less distinctness. The result is that the position of the reference point is, or seems to be (and we shall later see that every recollection implies an illusion) better and better known. By repetition this localization becomes immediate, instantaneous, automatic. It is like the forming of a habit. The intermediate points disappear, being of no use: the series is reduced to two terms, and these two terms suffice, because their distance from each other in time is known. Were it not for this *short cut*, the vast number of intermediate terms being disregarded, localization in time would be a very lengthy and difficult process, restricted within narrow limits. But by the aid of this, so soon as an image appears, its primary localization is instantaneous: it stands between two fixed points, namely, the present moment and some reference point. The operation is completed after a few trials, and is often laborious, and fruitless, and perhaps never precise.

If the reader will examine his own recollections, he will, I think, raise no serious objection to what has just been said. Further, he will observe how close is the resemblance between the process here employed, and that whereby we localize objects in space. In the latter case also we have reference points, short cuts, and distances fully ascertained, which we employ as units of measurement.

A few words may also be devoted, not without profit, to showing that localization in the future is effected by a similar process. Our knowledge of the future cannot be anything but a repetition of the past. Here I find only two categories of facts. They are either a mere reproduction of what has already occurred at similar epochs in the same places, under the same circumstances; or they consist of inductions, deductions and conclusions drawn from the past, but produced by the logical working of the mind. Outside of these two categories everything is possible, but everything is unknown.

Plainly the first of these classes of facts is the one that most closely resembles memory, for it involves simply the reproduction of what has been. Suppose a man has been wont every year to pass the month of September in a country house. In the depth of winter he sees it with its surroundings, its inmates, its daily routine. The image is at first indeterminate: it belongs equally to the past and to the future. First, it separates

*Taine, "On Intelligence," Part II, Book I, ch. II, § vi. A good analysis of this mental operation is given by Taine.

itself from the present: then it glides past winter, spring and summer; at last it becomes localized. The course of the year, with its succession of seasons, holidays, changes of occupation, supplies reference points. This process differs from memory only in one respect, namely, that here we pass from the *terminal* limit of the present, to the *initial* limit of the following state: we do not proceed, as in recollecting, from the beginning of one state of consciousness to the ending of another, but from an ending to a beginning. In this unchanging order we traverse, theoretically, all the intermediate states of consciousness, but practically we traverse only a few landmarks. The process is accordingly the same as in memory, only it works in the reverse direction.

In short, setting aside verbal explanations, we find that "recollection" is no "faculty" at all but a fact, and that this fact is the result of a sum of conditions. Hence, "recollection"—localization in time—varies with these conditions through all possible grades. In the highest grade are the reference points; next below these are vivid, well defined recollections, referred to their place in time past almost as quickly; then those that involve some hesitation, and require an appreciable time; lower still, labored recollections that take definite shape only after effort and resort to stratagem; last of all come those cases where all effort fails, and our indecision is expressed in such phrases as, "It seems to me that I have seen this form," "have I seen this in a dream?" One step further, and localization fails altogether: the image, stripped of its defining circumstances possesses nothing by which it can be definitely referred to any fixed time. There are many examples of this last case and they are to be found where we should least expect them. From the effects of disease or of old age, celebrated authors sometimes forget their own writings. Linné, toward the close of his life, took pleasure in reading his own works, and would exclaim, as he read, forgetting that he was himself the author: "Beautiful! I wish I had written that." The like is told of Newton and the discovery of the differential calculus. Walter Scott as he grew old was subject to this kind of forgetfulness. One day a poem was read to him which gave him pleasure, and he asked who was the author. It was a canto from his "Pirate." Ballantyne, who was his secretary and who wrote his life, relates in minute detail how the greater part of "Ivanhoe" was dictated during a painful illness. It was completed and published before its author had quit his bed. He had no recollections of it beyond the central idea of the story, which had antedated his illness.

In a case cited by Forbes Winslow, the image seems to be just on the point of being recognized, localized, but it falls short: "The poet Rogers, when ninety years of

age, was out driving with a lady. She inquired of him about another lady whom he could not recollect. He pulled the check-string and appealed to his servant. 'Do I know Lady M.?' The reply was 'Yes sir.' This was a painful moment to us both. Taking my hand, he said: 'Never mind, my dear. I am not yet compelled to stop the carriage and ask if I know you.'"^{*}

A much more instructive instance is recorded by Macaulay in his essay on Wycherley. Wycherley's memory, says he, was, toward the end of his life, at once exceedingly strong and exceedingly weak. If anything was read to him in the evening he would awake the next morning, his mind full of the ideas and the expressions heard the night before. He would write them out in perfect good faith, not doubting that they were his own. Here the mechanism of memory is plainly cut in twain, and pathology gives us its analysis. Interpreting this case according to the principles stated above, we should say: the modification impressed upon the brain-cells persisted; the dynamic associations of the nervous elements remained stable; the state of consciousness attaching to each was awakened; these several states of consciousness were again associated and again formed into series (sentences or verses). But there the mental operations suddenly stopped. These series did not awaken any secondary state; they remained isolated, without any relation to the present, without anything to fix their place in time. They remained as mental images, and they appeared new, because no concomitant state impressed on them the stamp of the past.

So far is localization in time from being a simple, primary, instantaneous act, that very often it requires a measurable interval even for consciousness. Where it appears to be instantaneous its rapidity is a result of habit. The eye, too, judges of the distance of objects, and it is probable that for nascent memory, as for nascent vision, localization is never instantaneous.†

Thus then we have discovered in the highest form of memory only one new operation—localization in time. We have now in conclusion to show the relatively illusory character of this operation.

^{*} Laycock, "Personal and Organic Memory," Carpenter, op. cit., p. 444; Ballantyne, "Life of Walter Scott"; Spring, "Symptomatologie," vol. 11, p. 530; Forbes Winslow, op. cit., p. 247.

† Note also what happens when events are many times repeated. I have made the journey from Paris to Brest a hundred times. The impressions of all these journeys overlap each other in my mind, forming a confused mass; properly speaking they constitute one vague image. Among them all, the journeys that are associated with some important event, whether fortunate or unfortunate, alone occur to me as recollections: only those which awaken secondary states of consciousness are localized in the mind, are recognized. The reader will observe that our explanation of the mechanism of "recollections" agrees with that given in Taine's "Intelligence," Part 2, Book 1, chap 11, § 6.

As I write I have a very vivid recollection of a visit I made a year ago to an old castle in Bohemia. The visit lasted two hours. To-day I easily make it over again in imagination: I enter at the great doorway, I pass in due order through the courts, corridors, halls and chapels as they rise story above story: I see again their frescoes and their decorations just as they are; I make my way fairly through this labyrinth of an old castle down to the moment of leaving, but I am unable to fancy the duration of this imaginary visit as equal in length to the two hours this moment just elapsed. It seems much shorter, and the difference would be much greater if the two hours just past had been spent in another visit of the same kind, or in some agreeable company. If we declare the two periods to be of equal length we do so on the evidence of time-pieces and in disregard of the evidence of our consciousness.

Every recollection, however distinct, suffers an enormous amount of abridgement: this fact is indisputable and has no exceptions. Scientific experiments in very simple cases, where the chances of error are inconsiderable, confirm this law. Vierordt has proved that if we try to imagine fractions of a second of time, our idea of any given fraction is always too large: the reverse holds when there is question of several minutes or several hours. In order to study the duration of these small intervals, he had the beats of a metronome noted for some time by a person who was required afterward to repeat the beats with the same rapidity. In the repetition the interval between the beats was too long when the original interval was short, and too short when the original interval was long.*

In proportion to the complexity of the states of consciousness the error increases. And what adds to the difficulty is the fact that this does not take place according to any appreciable law. It cannot be said to be in proportion to the length of time that may have elapsed; indeed we may assert the contrary. If I were to represent the last ten years of my life by a line one meter in length, the year just past would occupy three or four tenths of that line; the fifth, which was crowded with events, would take two-tenths; the other eight would be compressed within the remainder.

The same illusion is seen in history. Some centuries appear longer than others, and if I am not mistaken, the period from our day back to the taking of Constantinople seems longer than the period from that event back to the first crusade, though the two periods are very nearly equal in length of time. This probably results from the fact that the former

period is better known to us, and that in it our own recollections are involved.

As the present merges into the past, our states of consciousness disappear and are obliterated. Reviewed after the lapse of a few days, little or nothing of these remains; most of them have vanished into nothingness, never to be recalled, and they have taken with them the quantity of duration inherent in them; consequently an effacement of states of consciousness is an effacement of time. Now the "short cuts" processes already spoken of presuppose this effacement. If, in order to recollect something in the distant past we had to go over the whole series of terms between now and then, memory were impossible, owing to the length of time the operation would require.*

Thus we reach the paradoxical result that forgetfulness is a condition of memory. Were it not for our totally forgetting a vast number of states of consciousness and momentarily forgetting a great many, we could not recollect anything. Forgetfulness therefore is not, except in certain cases, a disease of memory, but rather one condition of its healthful action and of its life. In this we find a striking analogy with the two great vital processes. To live is to gain and to lose; life consists as much in the work that eliminates as in that which assimilates. Forgetfulness is elimination.

A second result (and this brings us back again to the functions of vision) is that our knowledge of the past is like a painting with perspective reaching far into the distance, at once deceptive and true, for its truth is based on illusion. If on an hypothesis that never will be realized we could compare our actual past as it was, set objectively before us, with the subjective representation of the same furnished to us by memory, we should see that this copy is constructed on a particular system of projection; each of us readily finds his bearings in this system, for it is of his own making.

IV.

Thus we have reached, step by step, the highest development of memory; we will now follow the inverse order and come again back to our starting-point. This return is necessary, in order to show a second time that memory is a process of organization in

*Vierordt, "Der Zeitsinn nach Versuchen," 26—111. H. Weber, "Tastsinn und Gemeingefühl," 87, has made analogous experiments on visual perceptions. See also "Handbuch der Physiologie" (1879), edited by Hermann, vol. II. part 2, p. 282.

*Abercrombie, in his "Intellectual Powers," mentions a circumstance which confirms what is here said: "The late Dr. Leyden was remarkable for his memory. I am informed, through a gentleman who was intimately acquainted with him, that he could repeat correctly a long Act of Parliament, or any similar document, after having once read it. When he was, on one occasion, congratulated by a friend for his remarkable power in this respect, he replied that, instead of an advantage, it was often a source of great inconvenience. This he explained by saying that, when he wished to recollect any particular point, in anything which he had read, he could do it only by repeating to himself the whole from the commencement till he reached the point which he wished to recall."

varying degrees between two extreme limits, namely, a new state and organic registration.

There is no form of mental activity that bears witness more effectively in favor of the theory of evolution: from that point of view, and from that alone, can we understand the nature of memory; and it is seen that the study of memory must be not only a study in physiology, but also in morphology, *i. e.* a history of its transformations.

Let us then take up the question where we left it. A new mental acquisition more or less complex is revived for the first or for the second time. Such recollections are the most instable of the elements of memory—so instable that many of them vanish for good; such are most of the occurrences that happen to us daily and hourly. However clear, however intense, they have a minimum of organization. But every time they return to the mind, whether voluntarily or involuntarily, they gain in stability—their tendency to become organized grows stronger.

Below this group of fully conscious and unorganized recollections stands the group of conscious and semi-organized recollections; for example a language we are by degrees learning, a scientific theory or a handicraft that we have only half mastered. Here the strongly individual character of the first group disappears, and the recollection becomes more and more impersonal—becomes objective. The localization in time disappears, being useless. Here and there a few isolated terms carry with them personal impressions which localize them. I remember having learned such a German or English word in such a town, or under such circumstances. It is a *survival*, a work of a prior state, an original impress. Little by little it is effaced, and the term assumes the same commonplace and impersonal character as all other terms.

This knowledge of a science, a language, a handicraft becomes more and more rooted. It retreats by degrees from the psychic sphere, and becomes more and more like an organic memory. Such, in the case of an adult person, is his memory of his mother tongue.

One step lower, and we come to memory completely organized and nearly unconscious, as seen in the clever musician, the skilled mechanic, the accomplished danseuse. Nevertheless, all this was once memory in the strict and ordinary sense of the word—fully conscious memory.

We may go lower still. The exercise of every one of our senses (of sight, of touch; in walking, etc.), presupposes a completely organized memory; but so incorporated is it in our nature that most persons never suspect it to be acquired. The same can be said of many of our habitual judgments. No one *remembers* that the object at which he is looking has an opposite side; or that a certain modification of the visual impression implies a certain distance; or that a certain

motion of the legs will move him forward; or that the thing which he sees moving about is a live animal. It would be thought a misuse of language were any one to ask another whether he *remembered* that the sun shines, that fire burns, that iron is hard, and that ice is cold.* Nevertheless, all this, we repeat, was once memory in the strict sense, in a nascent intelligence.

It is not necessary to add that the foregoing is a purely ideal sketch, a schematism. It were vain to endeavor to define with precision the several stages of an evolution that proceeds by infinitesimal transitions varying according to the individual.

Can we go further still? We might. Below the composite reflex actions which represent organic memory in its lowest phase we have simple reflex actions. We may conceive the latter—which are the result of a congenital anatomical arrangement—as being themselves acquired and made fixed by innumerable experiences in the course of the evolution of species. Thus we should pass from the memory of the individual organism (*individual* memory) to heredity, which is the memory of the species (*specific* memory). It is enough to simply refer to this hypothesis.

In fine it is impossible to say where memory, whether psychic or organic, ends. That which we designate by the collective name, memory, comprises series exhibiting all degrees of organization, from the nascent to the perfect state. There is incessant transition from the stable to the instable; from the state of consciousness, where acquisition is precarious, to the organic state, where acquisition is assured. In consequence of this steady tendency toward organization, a degree of simplification and order is given to the contents of memory which makes a higher form of thought possible. But the tendency to organization, left to itself, without a check, would tend to the progressive annihilation of consciousness; would reduce man to an automaton.

Suppose—though the hypothesis is one that cannot be realized—suppose an adult human being placed in such conditions that he has no more new states of consciousness—no new sensations, ideas, concepts, sentiments, or desires: the different series of states of consciousness which constitute each form of psychic activity would at last become so well organized as to make him a hardly conscious automaton. Narrow minds that always move in the same ruts reduce this hypothesis to a reality in some degree. Restricted within a narrow sphere, they have very little contact with what is new and strange, and hence tend toward the state of perfect stability; they become mere machines; so far as the greater part of their life is concerned, consciousness is superfluous.

* Herbert Spencer, "Psychology," Part IV., *ca.* vi., § 192.

Having considered the subject in all its aspects, we revert to the proposition stated at the outset, viz.: conscious memory is only a special phase of biological memory. We may now, by recourse to another class of considerations, show once more that memory is subject to the fundamental conditions of life.

All forms of memory, from the highest to the lowest, have for their groundwork dynamic associations between the nerve elements, and special modifications of these elements, at least of the cells. These modifications, resulting from a first impression, are retained by no inert matter—they do not resemble the impress of a seal on wax. They are impressed upon living matter. Now all living tissues are ever in process of molecular renewal, nerve tissue more than any other, and in nerve tissue the grey substance more than the white, as is proved by the extraordinary abundance of bloodvessels pervading it. Now, since the modifications persist, it follows that the arrangement of the molecules of new-formed tissue must exactly reproduce the type of the effete molecules to which they succeed. Memory is directly dependent on *nutrition*.

But not only have these cells the property of self-nutrition: they also possess, at least during a portion of their life, the power of reproduction, and we shall later see how this fact accounts for certain cases of the re-establishment of memory. All physiologists hold this reproduction to be simply a form of nutrition: therefore the basis of memory is nutrition—the vital process *par excellence*.

For the present I will not dwell upon this point. After we have considered the disorders of memory, its exalted and its depressed states, its momentary suspension, its eclipse and sudden return, its progressive impairment, we may return to the question with advantage: the capital importance of nutrition will then be self evident. Hitherto we have been occupied with the preliminaries of our subject—memory in its healthy state; it is time to study it in the morbid state. The pathology of memory is the complement of its physiology; we shall see whether it lends confirmation to it.

CHAPTER II.

GENERAL AMNESIA.

Classification of the diseases of memory—Temporary amnesia—Epileptics—Forgetfulness of certain periods of life—Examples of re-education—Slow and sudden recoveries—Case of provisional memory—Periodical or intermittent amnesia—Formation of two memories, totally or partially distinct—Cases of hypnotism recorded by Maenish, Azam and Dufay—Progressive amnesia—Its importance; reveals the law which gov-

erns the destruction of memory—Law of regression; enunciation of this law—In what order memory fails—Counter-proof; it is reconstituted in inverse order—Confirmatory facts—Congenital amnesia—Extraordinary memory of some idiots.

Material for the study of the diseases of memory exists in abundance. It is found scattered through medical works, treatises on mental diseases, and the writings of divers psychologists. It may be brought together without overmuch labor, and then we have at hand a sufficient store of observations. The difficulty is to classify, to interpret, to draw conclusions as to the mechanism of memory. In this respect the facts gleaned are of very unequal worth; the most extraordinary ones are not the most instructive. The physicians to whom we are indebted for most of them have described and studied them almost exclusively with reference to their own art. In their eyes a disorder of memory is but a symptom, and they note it as such; it is of use as a guide in diagnosis or prognosis. So with regard to classification; they content themselves with a reference of each case of amnesia to the morbid state whose effect it is—brain softening, hemorrhage, concussion, intoxication, etc.

For our purpose, on the other hand, the diseases of memory must be studied in themselves as morbid psychic states which may enable us the better to understand the normal state. As for classification we must needs ground it upon likenesses and differences. The subject has not yet been sufficiently studied to attempt a natural classification, *i. e.*, by causes. I would therefore remark that the classification here offered is designed simply for the purpose of reducing to something like order a confused and heterogeneous mass of facts; that in many respects it is arbitrary, I am free to confess. Disorders of memory may be restricted to one single class of recollections, all the rest remaining intact, at least apparently; these are *partial* disorders. Others, on the contrary, affect the entire memory in all its forms; cut the mental life in twain or break it up into many fragments; produce chasms that cannot be filled, or destroy it utterly by agencies that work step by step.

We thus recognize, in the first place, two great classes, the general and the partial diseases of memory. We propose to consider them under the following heads: 1. Temporary Amnesia; 2. Periodic Amnesia; 3. Progressive Amnesia, least curious of all, but most instructive; 4. Congenital Amnesia.

I.

Temporary amnesia usually comes suddenly and disappears in the same way. It lasts for a period of time that may vary from five minutes to years. The briefest and clearest cases, as also the most common, occur in epilepsy.

Physicians are not agreed either as to the nature, the seat or the causes of this disease. The problem does not belong to our subject, nor is it within our province. Suffice it to say that authors with one accord recognize three forms of the disease: "grand mal," "petit mal," and vertigo; that they regard these less as distinct varieties than as degrees of the same morbid state; finally, that the milder the disease in its external manifestation, the graver its effects on the mind. The fit is succeeded by mental derangement which may betray itself by oddities and absurd acts, or by crimes. All these acts possess a common character called by Hughlings Jackson *mental automatism*. They leave no recollection, save in rare cases, where a few faint traces of memory remain.

A patient while advising with his physician is seized with epileptic vertigo. He recovers immediately, but forgets that he paid the fee a moment before the attack.* A clerk finds himself seated at his desk, his thoughts slightly confused, but otherwise without ailment. He remembers having ordered dinner at a restaurant, but from that moment forward he has no recollection of anything. He goes back to the restaurant, and there learns that he has eaten dinner and paid the bill, and that he left for his office without appearing to be ill. In this instance memory was in abeyance for about three quarters of an hour. Another epileptic, seized with a fit in a shop, falls to the floor, rises again, and runs away leaving behind his hat and notebook. "I was found," said he "a quarter of a mile away; I inquired for my hat in all the shops, but I was unconscious of what I was doing, and did not come to myself again till ten minutes later, when I reached the railroad." Trousseau relates the case of a magistrate who, while attending a meeting of a learned society in the Hotel de Ville, Paris, went out bare-headed, walked as far as the Quai, and returned to his place to join in the discussions, without any recollection of what he had done.

Oftentimes the patient keeps on performing, during the period of automatism the acts in which he may have been engaged at the moment of the attack, or he comments upon something he may have been reading. Instances of this were given in the preceding chapter. Nothing is more common than unavailing attempts at suicide, but when the fit of epileptic vertigo has passed there is no recollection of them whatever. The same is true with regard to criminal attempts. A shoemaker seized with epileptic mania on his wedding day, killed his father-in-law by stabbing him with his knife. Coming to his senses a

few days afterward, he had not the faintest suspicion of what he had done.

From these examples the reader may get a better understanding of the nature of epileptic amnesia than from any general description of it. A certain period of mental activity is as though it had never been. The epileptic knows of it only from the testimony of others, or from vague conjectures. Such is the fact. As for its psychological interpretation, there are two possible hypotheses.

Either (1) the period of mental automatism was unaccompanied by consciousness, and in that case the amnesia needs no explanation, for as nothing was produced, so nothing can be retained or reproduced; or (2) there was consciousness, but so faint that amnesia ensues. This second hypothesis I believe to be the true one in a great many instances.

In the first place, as a matter simply of reasoning, it is difficult to see how very complex acts adapted to different ends can be performed without some measure of consciousness at least intermittent. Be the force of habit as great as you please, it must for all that be remembered that it where uniformity of action exists consciousness tends to disappear; on the other hand, it tends to manifest itself wherever there is diversity of action.

But reasoning can give only possibilities; experience alone is decisive. Now there are facts which go to prove the existence of a certain measure of consciousness even in the exceedingly numerous cases where the epileptic retains no remembrance of his paroxysm. "Some epileptics, on being questioned abruptly and in a commanding tone, reply in a low and plaintive voice. When the attack has passed, they recollect neither what has been said to them nor what they have themselves answered. . . . A child, forced during an attack to inhale ether or ammonia, the odor of which was to it unbearable, would angrily cry out, 'go away, go away!' When the fit was over, the patient had no recollection of these occurrences. . . . Sometimes epileptics contrive, after much effort, to recall sundry occurrences that took place during the paroxysms, particularly those of the last few moments of the seizure. . . . In that case they are in a situation comparable to that of one awakening out of a distressing dream. At first the main circumstances of the attack escape them, and they disclaim all knowledge of the acts imputed to them; but little by little they recall sundry details which at first they seemed to have forgotten."*

If in these cases circumstances go to prove that consciousness existed, it is not rash to assert its existence in many other cases. Still I do not mean to assert that this holds for all cases. The magistrate mentioned above directed his steps with sufficient discretion to

* The facts here cited are taken for the most part from a memoir by Dr. H. Jackson, published in the *West Riding Asylum Review*, and from an article by Falret on the mental state of epileptics, in the *Archives de Médecine*, December, 1860, April and October, 1861.

*Trousseau, "Leçons Cliniques." Vol. II.; p. 114.

avoid obstacles, vehicles and passers-by, and this indicates a certain consciousness; but in a similar case mentioned by Hughlings Jackson, the patient was thrown down by an omnibus, and on another occasion came near falling into the Thames.

How then are we to explain amnesia in cases where consciousness exists? By the extreme feebleness of the states of consciousness. There are only two means of giving fixity to a state of consciousness, viz.: intensity and repetition. The latter is reducible to the former, for repetition is a sum of lesser intensities. Here there is neither intensity nor repetition. The mental disturbance which follows the paroxysm is very well defined by Jackson when he calls it "an epileptic dream." One of his patients, nineteen years of age, and a person very unlikely to dogmatize on the subject, of his own accord hit upon the same expression. "Last time he had a fit and went to bed, and when in bed said, 'Wait a bit, Bill, I am coming.' He went down stairs; he unbolted the doors, and went out in his night-shirt. He came to himself just as he was stepping on the cold stones, and then his father touched him. He said he had had a dream. 'It's all right, I have had a dream!'"

In order to proceed from the known to the unknown, let us compare the mental state of epileptics with that of a dreamer. Dreams, of which all recollection disappears instantly, are very common. We awake in the night out of a dream; the recollection of the interrupted dream is very clear; next morning not a trace remains. Who is there who has not tried over and over, in vain, to recall some dream of the previous night, of which he remembers nothing, except that he has had a dream?

The explanation is simple. The states of consciousness that make up a dream are extremely faint. They appear to be strong, not because they really are so, but because there is no strong state of consciousness to force them into the background. So soon as the waking state begins again everything resumes its own place. Images fade away in the presence of sense perceptions, these in the presence of a state of fixed attention, and this in the presence of a fixed idea. In short, consciousness during dreams has a minimum intensity.

Hence the difficulty is to explain why, during the period following an epileptic seizure, consciousness falls to a minimum. Neither physiology nor psychology can explain it, for neither science knows anything about the conditions of the genesis of consciousness. The problem is the more embarrassing because amnesia attaches to the delirium of epilepsy and to that delirium only, as we see in the case of those who are both epileptics and victims of alcoholism. A patient is seized with an epileptic fit during the day; he smashes everything within reach, and is vio-

lent in every way. After a brief period of quiet, he falls during the night into alcoholic delirium, which is characterized by frightful visions. Next day, coming to himself, he distinctly recollects the delirium of the night before, but has no remembrance of the delirium of the preceding day.

There is still another difficulty. If the amnesia is due to the weakness of the primary states of consciousness, how comes it that these faint states of consciousness determine the patient to acts? According to Hughlings Jackson, "mental automatism results from over action of low nervous centers, because the highest or controlling centers have been put out of use." We have here only an illustration of a well-known physiological law, viz., that the excito-motor power of the reflex centers increases when their connection with the superior centers is broken.*

Let us consider only the psychological problem: a solution of that is possible. If we insist on making consciousness a "force" self-existent and self-acting, everything becomes obscure. But if we hold, as was explained in the preceding chapter, that consciousness is a concomitant of a nervous state, and that this nervous state is the fundamental element, all becomes clear. At least it is no contradiction to say that a nervous state sufficient to determine certain acts is insufficient to awaken consciousness. To produce a movement and to produce a state of consciousness are two distinct and independent facts; the conditions of the one are not those of the other.

In conclusion, we may note that the inevitable consequence of repeated epileptic seizures, especially those of epileptic vertigo, is a progressive weakening of memory in its entirety. We shall later study this form of amnesia.

We now pass to cases of temporary amnesia of a destructive character. In the examples already cited, the capital accumulated down to the moment of the seizure is not impaired; the only effect is that something that was in the consciousness does not remain in the memory. In the examples which follow, a part of the capital is lost. Such cases make most impression on the imagination. Possibly some day, as physiology and psychology advance, they will from these cases teach us much regarding the nature of memory; just now these facts are not the most instructive—at least, in my estimation, whatever they may disclose to others.

These cases differ widely from one another. Sometimes the suspension of memory

*"A highly important character of epileptic mania," says Falret, *loc. cit.*, "is the absolute likeness of all the attacks in the same patient, not only their likeness as a whole, but in every detail. The same patient expresses the same thoughts, utters the same words, performs the same acts. There is a surprising uniformity in all the paroxysms."

begins at the onset of the disease, covering events that happen thereafter; again, it covers the events occurring just previous to the seizure; generally it extends in both directions, both to the time before and the time after the attack. Sometimes memory returns spontaneously, suddenly; sometimes slowly and with some little assistance; sometimes the loss of memory is total and the patient has to learn everything over again. We will present instances of all these different phases.

"A young woman, wedded to a man she loved passionately, was seized in child-bed with a long syncope, at the termination of which it was found that she had lost all memory of the time after and including her marriage. All the rest of her life down to that moment she remembered quite distinctly. At first she repelled her husband and her child, when presented to her. She never was able to regain the memory of that period of her life, nor of the events belonging to it. Her relatives and friends succeeded, by reasoning with her and by the force of their testimony, in persuading her that she had been married, and was a mother. She credited them, preferring to believe that she had lost the memory of a year, rather than to hold them all to be impostors. But her own convictions, her own inmost consciousness had no part in this. She saw before her her husband and her infant, but could not imagine by what magic she had won the one or given birth to the other."*

Here we see an instance of incurable amnesia, extending only backward in time. As for its psychological explanation, that is to be found in the destruction of the residua and the impossibility of their reproduction. In the following case, reported by Laycock, the amnesia extends forward only, and hence is to be attributed only to the fact that the states of consciousness cannot be registered and preserved. The engineer of a steamship had a fall upon his back, striking the back of his head against some hard object. For a while he lay unconscious. Coming to himself, he soon regained perfect physical health; he retained recollection of all the years preceding the accident, but from that moment forward memory no longer existed, even concerning facts strictly personal. On reaching the hospital he could not say whether he had come afoot, in a carriage or by railroad. On leaving the dinner table he forgot that he had taken that meal; he had no idea what hour, or day, or week it might be. He would strive to reflect so as to answer questions, but in vain. His speech was slow, but his language was correct. He says what he intends to say, and he reads correctly. This infirmity of mem-

ory gave way before suitable medical treatment.*

As a general rule, in cases of temporary amnesia, due to concussion of the brain, a retroactive effect is produced. The patient, on returning to consciousness, is found not only to have lost the recollection of the accident and the period succeeding it, but also to have forgotten a longer or shorter period prior to it. Many instances might be quoted in confirmation of this; I will cite only one, mentioned by Carpenter. †

A Mr. H. "was driving his wife and child in a phaëton, when the horse took fright and ran away; and, all attempts to pull him in being unsuccessful, the phaëton was at last violently dashed against a wall, and Mr. H. was thrown out, sustaining a severe concussion of the brain. On recovering, he found that he had forgotten the *immediate* antecedents of the accident; the last thing he remembered being that he had met an acquaintance on the road, about two miles from the scene of it. Of the efforts he had made and the terror of his wife and child he has not to this day any recollection whatever."

We next give some cases of amnesia of a far more serious character, some of them necessitating a complete re-education: I take them from the English magazine, "Brain."

The first observation, reported by Dr. Mortimer Granville, was made in the case of a hysterical woman twenty-six years of age, who, after over-exerting herself, was seized with a violent fit, accompanied with total loss of consciousness. "When consciousness began to return, the latest sane ideas formed previous to the illness mingled curiously with the new impressions received, as in the case of a person awakening slowly from a dream. When propped up with pillows in bed near the window, so that persons in the street could be seen, the patient described the moving objects as 'trees walking'; and when asked where she saw these things, she invariably replied, 'in the other Gospel.' In short, her mental state was one in which the real and ideal were not separable. Her recollections on recovery, and for some time afterward, were indistinct, and, in regard to a large class of common topics which must have formed the staple material of thought up to the period of the attack, memory was blank. Special subjects of thought immediately anterior to the malady seemed to have saturated the mind so completely that the early impressions received after recovery commenced were imbued with them, while the cerebral record of penultimate brain-work in the life before the morbid state, was, as it were, obliterated. For example, although this young woman had supported herself by daily duty as a governess she had no recollection of so simple a matter as the use of a

* "Lettre de Charles Villiers à G. Cuvier." (Paris, Lenormant, 1802).

* Laycock, on "Certain Disorders and Defects of Memory." Page 12.

† Op. Cit., p. 450.

writing implement. When a pen or pencil was placed in her hand, as it might be thrust between the fingers of a child, the act of grasping it was not excited, even reflexly; the touch or sight of the instrument awoke no association of ideas. The most perfect destruction of brain-tissue could not more completely have effaced the constructive effect of education and habit on the cerebral elements. This state lasted some weeks."* Memory of what had been forgotten was recovered slowly, painfully, though there was no necessity for so complete a re-education as in the next case.

The second observation, which we owe to Professor Sharpey, furnishes one of the most curious instances of re-education ever recorded. I take from his long article only the psychological details. Here, too, the subject was a woman twenty-four years of age, and of delicate constitution, who for some six weeks suffered from an irresistible tendency to fall asleep. This condition grew more pronounced from day to day. About June 10 it was impossible to awaken her. She continued thus for two months. She was fed with a spoon, and swallowed the food: when she had had enough, she closed her teeth and turned her mouth away. She appeared to distinguish flavors, for she steadily refused certain kinds of food. At long intervals she had brief moments of waking. She answered no questions and recognized nobody, save once when she recognized "an old acquaintance, whom she had not seen for more than twelve months. She looked steadfastly in this person's face for a few seconds, apparently occupied in trying to remember his name, which at length she found out and repeated again and again, at the same time taking him by the hand as if overjoyed to see him. She then again fell into her slumber." Toward the end of August she returned little by little to her normal state.

Here began the work of re-educating her. "On her recovery from the torpor, she appeared to have forgotten nearly all her previous knowledge; everything seemed new to her, and she did not recognize a single individual—not even her nearest relatives. In her behavior she was restless and inattentive, but very lively and cheerful; she was delighted with everything she saw or heard, and altogether resembled a child more than a grown person.

"In a short time she became more sedate, and her attention could be longer fixed on one object. Her memory, too, so entirely lost, as far as regarded previous knowledge, was soon found to be most acute and retentive with respect to everything she saw or heard subsequently to her disorder, and she has by this time recovered many of her former acquirements, some with greater, others with less facility. With regard to these, it is re-

markable that though the process followed in regaining many of them apparently consisted in recalling them to mind with the assistance of her neighbors rather than in studying them anew, yet even now she does not appear to be in the smallest degree conscious of having possessed them before.

"At first it was scarcely possible to engage her in conversation; in place of answering a question, she repeated it aloud in the same words in which it was put, and even long after she came to answer questions she constantly repeated them once over before giving her reply. At first she had very few words, but she soon acquired a great many, and often strangely misapplied them. She did this, however, for the most part in particular ways; she often, for instance, made one word answer for all others which were in any way allied to it. Thus, in place of 'tea,' she would ask for 'juice,' and this word she long used for liquids. For a long time, also, in expressing the qualities of objects, she invariably, where it was possible, used the words denoting the very opposite of what she intended, and thus she would say 'white' in place of 'black,' 'hot' for 'cold,' etc. She would often, also, talk of her arm when she meant her leg, her eye when she meant her tooth, etc. She now generally uses her words with propriety, although she is sometimes apt to change her terminations or compose new ones of her own.

"She has as yet recognized no person, not even her nearest connections; that is to say, she has no recollection of having seen or known them previous to her illness, though she is aware of having seen them since, and calls them either by their right names or by those of her own giving, but she knows them only as new acquaintances, and has no idea of what relations they sustain to herself. She has not seen above a dozen people since her illness, and she looks on these as all that she has ever known.

"Among other acquirements, she has recovered that of reading; but it was requisite to begin with the alphabet, as she at first did not know a single letter. She afterward learned to form syllables and small words, and now she reads tolerably well, and has shown herself much interested in several stories previously unknown to her, which she has read since her recovery. The re-acquisition of her reading was eventually facilitated by singing the words of familiar songs from the printed page, while she played on the piano. In learning to write she began with the most elementary lessons, but made much more rapid progress than a person who had never before been taught. Very soon after the torpor left her she could sing many of her old songs, and play on the pianoforte with little or no assistance, and she has since continued to practice her music, which now affords her great pleasure and amusement. In singing, she at first generally required to be helped

* "Brain," Oct. 1879, p. 317, seqq.

to the first two or three words of a line, and made out the rest apparently from memory. She can play from the music book several tunes which she had never seen before; and her friends are inclined to think that she now plays and sings fully as well, if not better, than she did previously to her illness. She learned backgammon, which she formerly knew, and several games at cards, with very little trouble; and she can now knit worsted, and do several other sorts of work; but with regard to all these acquirements, as already mentioned, it is remarkable that she appears not to have the slightest remembrance of having possessed them before, although it is plain that the process of recovery has been greatly aided by previous knowledge, which, however, she seems unconscious of having ever acquired. When asked how she had learned to play the notes of music, from a book, she replied that she could not tell, and only wondered why her questioner could not do the same.

"She has once or twice had dreams, which she afterward related to her friends, and she seemed quite aware of the difference betwixt a dream and a reality; indeed, from several casual remarks which she makes of her own accord, it would appear that she possesses many general ideas of a more or less complex nature, which she has had no opportunity of acquiring since her recovery."

So far as we may judge from Dr. Sharpey's narrative this re-education did not take more than three months; nor is that an unexampled circumstance. "A clergyman, of rare talent and energy, of sound education, was thrown from his carriage and received a violent concussion of the brain. For several days he remained utterly unconscious, and when restored his intellect was observed to be in a state similar to that of a naturally intelligent child. Although in middle life, he commenced his English and classical studies under tutors, and was progressing satisfactorily, when, after several months' successful study, his memory gradually returned, and his mind resumed all its wonted vigor and its former wealth and polish of culture."

"A gentleman about thirty years of age, of learning and acquirements, at the termination of a severe illness, was found to have lost the recollection of everything, even the names of the most common objects. His health being restored, he began to re-acquire knowledge like a child. After learning the names of objects, he was taught to read, and, after this, began to learn Latin. He made considerable progress, when, one day, in reading his lesson with his brother, who was his teacher, he suddenly stopped and put his hand to his head. Being asked why he did so, he replied, 'I feel a peculiar sensation in my head; and now it appears to me that I

knew all this before.' From that time he rapidly recovered his faculties."*

I hold it sufficient, for the present, to lay these facts before the reader. The remarks they suggest will find more suitable place elsewhere. I shall conclude with a case little known, which marks the natural transition to intermittent amnesia. We shall, in fact, see gradually formed a provisional memory, and this again suddenly disappearing before the original memory.

A young woman, robust and healthy, accidentally fell into a river and was nearly drowned. She was insensible for six hours and then returned to consciousness. Ten days afterward she fell into a profound stupor which lasted four hours. On opening her eyes she no longer recognized any one, and she was deprived of hearing and speech, taste and smell. She retained only sight and touch, and these senses were of extreme sensibility. Ignorant of everything, and unable to stir, she was like an animal deprived of its brain. She had a good appetite, but she had to be fed; she ate all sorts of food indifferently, swallowing it in purely automatic fashion. Indeed, so strictly automatic was her whole activity that for days her only occupation consisted in unraveling, picking or clipping into minute pieces everything that came to her hand, as flowers, paper, clothing, etc., and then arranging the scraps to form certain rude patterns. Later her friends supplied the materials for making patchwork, and after a few preparatory lessons she took up the needle and worked incessantly from morning till night, making no distinction between Sunday and week-day, and even unable to perceive the difference. She retained no recollection of events from one day to another, and each morning she began a new task. Still, like an infant, she was beginning to register a few thoughts and to acquire some experience. She was next put at work of a little higher character, worsted work. She seemed to take great pleasure in gazing at the patterns with their flowers and their harmony of colors; but each day she would commence a new piece, forgetting that of the day before, unless it was set before her.

The thoughts derived from her former experience that seemed to be first reawakened, were connected with two matters that had made a strong impression upon her, namely, the fall into the river and a love affair. When a landscape was shown her containing a river or a view of a troubled sea, she became greatly agitated, and forthwith would have an attack of spasmodic rigidity accompanied by insensibility. So great was the fright given her by the sight of water, especially water in motion, that pouring water from one vessel into another was enough to make her tremble. It was observed that when

* "Brain," April, 1879.

† Forbes Winslow, *op. cit.*, p. 317.

* *Ibid.*

she washed her hands, she simply dipped them in the water, as gently as possible.

From the beginning of her malady the visits of a young man to whom she was attached gave her evident pleasure, even while she was insensible to everything else. He came regularly every evening, and she always looked for his arrival. At a time when she could not recall any occurrence an hour after it had happened, she used to look anxiously for the door to open at the accustomed hour, and if he did not come, she would be ill-humored the rest of the evening. On being taken into the country, she became low-spirited, irritable, and her paroxysms were frequent. But while the young man remained near her, her intellectual faculties and her memory were visibly improved.

This return of her faculties was going on gradually all the time. One day seeing her mother much grieved, she suddenly exclaimed, after a moment's hesitation, "What is the matter?" From that moment forth she began to articulate a few words, though she called neither persons nor things by their true names. The pronoun "this," was her favorite word, and she applied it to all sorts of objects, animate and inanimate alike. The first objects she called by their own names were wild flowers, for which she had shown a strong liking from her childhood. At this period she had as yet no recollection whatever of the places or the persons associated with her early years.

"The mode of recovery of this patient was quite as remarkable as anything in her history. Her health and bodily strength seemed completely reestablished, her vocabulary was being extended, and her mental capacity was improving, when she became aware that her lover was paying attention to another woman. This idea immediately and very naturally excited the emotion of jealousy; which, if we analyze it, will appear to be nothing else than a painful feeling connected with the idea of the faithlessness of the object beloved. On one occasion this feeling was so strongly excited that she fell down in a fit of insensibility, which resembled her first attack in duration and severity. This, however, proved sanatory. When the insensibility passed off, she was no longer spell-bound. The veil of oblivion was withdrawn; and, as if awakening from a sleep of twelve months' duration, she found herself surrounded by her grandfather, grandmother, and their familiar friends and acquaintances. She awoke in the possession of her natural faculties and former knowledge, but without the slightest remembrance of anything which had taken place in the year's interval from the invasion of the first fit up to the present time. She spoke, but she heard not; she was still deaf, but, being able to read and write as formerly, she was no longer cut off from association with others. From this time she rapidly improved, but for a while

continued deaf. She soon perfectly understood by the motion of her lips what her mother said; they conversed with facility and quickness together, but she did not understand the language of the lips of a stranger. She was completely unaware of the change in her lover's affections, which had taken place in her state of 'second consciousness;' and a painful explanation was necessary. This, however, she bore very well; and she has since recovered her bodily and mental health."*

We shall see further on, when we shall have traversed all the facts, what general conclusions as to the mechanism of memory are to be drawn from its pathology. For the moment we shall restrict ourselves to a few observations suggested by the foregoing facts.

In the first place we would remark that the cases just cited, though classed by physicians under the general head of total amnesia, in reality belong, from the psychological point of view, to two different morbid types.

The first type (represented by the cases observed by Villiers, Laycock, Mortimer, Granville, etc.) is by far the more frequent. We have given only a few examples, so as not to weary the reader with monotonous and unprofitable repetition. What characterizes this type, psychologically, is the fact that here the amnesia attaches only to the least automatic and least organized forms of the memory. In cases belonging to this morbid group neither the habits nor skill in any handicraft, as sewing or embroidery, nor the power of reading or writing, or speaking one's own or other languages, disappears; in short, memory in its organized or semi-organized form, remains intact. The destruction of memory in these cases affects only its highest and most instable forms, those personal in character and which, being accompanied by consciousness and localization in time, constitute that which in the preceding chapter we called psychic memory proper. It is further to be remarked that the amnesia covers the most recent events—extending backward from the present over a period of variable duration.† This may at first cause surprise, for our latest recollections would seem to be the most vivid, the strongest. But, in fact, this result is perfectly natural, the stability of a remembrance being in a direct ratio to its degree of organization. But I will not dwell upon this point, which will be considered at length elsewhere.

The physiological reason of amnesia in this group is purely hypothetical, and it probably is different in different cases. First (as we see especially in Laycock's observation)

* Dunn, in the "Lancet," 1845. See Carpenter, *op. cit.* p. 460, *et seq.*

† I must, however, mention a case reported by Brown-Séquard, where a patient, in consequence of an attack of apoplexy, lost recollection of five years of his life. These five years, which included the time of his marriage, ended just six months before the date of his attack.

the power of registering new experiences is temporarily suspended; states of consciousness disappear as quickly as they appear, leaving no trace. But what becomes of the recollections registered previously for weeks, and months and years? They persisted, they were preserved and were recalled formerly; they seemed to be a lasting acquisition, yet in their place is now a void. This the patient fills by device and indirectly from the testimony of others and from his own reflections, thus more or less satisfactorily connecting his present with what remains to him of his past. It does not appear from the observations made that he ever fills this void by a direct reminiscence. Hence two suppositions are equally warranted; viz., that either the registration of the prior states has been effaced; or that the retention of the anterior states persisting, their aptitude for being revived by associations with the present is destroyed. We are not in a position to decide between these two hypotheses.

The other, and less frequent morbid type is represented in the cases reported by Sharpey and Winslow (that observed by Dunn marks a transition to intermittent amnesia). Here the work of destruction is complete: memory in all its forms—organized, semi organized, and conscious—is done away. There is complete amnesia. As we have seen, the authors who have described it compare the patient to an infant and his mind to a *tabula rasa*. These expressions, however, are not to be taken in the strict sense. The cases of re-education which we have cited show that though all prior experience is made null, there yet remain in the brain some few latent aptitudes. The extreme rapidity of the new education, especially in its later stages, were otherwise inexplicable. Facts tend to prove beyond question that this recovery of aptitudes, which seems the work of artifice, is above all the work of nature. The memory returns because the atrophied nerve elements are in time succeeded by other nerve elements possessing the same properties, whether original or acquired, as those they succeed. This is another proof of the relation which subsists between memory and nutrition.

Finally—for all cases of amnesia cannot be reduced to one formula—in cases where the loss and the recovery of memory are sudden we readily perceive the analogues of those phenomena of arrest of function or "inhibition," now closely studied by physiologists, but of which very little is known.

II.

The study of periodical amnesia is far better calculated to throw light upon the nature of the Ego and the conditions of existence of the conscious personality, than to exhibit the mechanism of memory under a new aspect. It forms an interesting portion of a work that has never yet been written in

full and whose title might be "Diseases and Aberrations of Personality." It will be difficult for us to avoid touching upon this subject every moment, but I shall endeavor to say of it only what is indispensable for clearness of exposition.

I shall be sparing of illustrative facts, for they are sufficiently known. The study of so-called cases of "double consciousness," is quite in the fashion. Dr. Azam's detailed and instructive study, in particular, has given the general reader a clearer idea of what is meant by periodic amnesia, than could be got from any definition. I shall, therefore, content myself with a review of the principal cases, proceeding from the most perfect phase of periodic amnesia to its most elementary forms.

I. The clearest, most unquestionable and most perfect case of periodic amnesia on record is that given by Macnish in his "Philosophy of Sleep," and which has since been oftentimes quoted: A young American woman, on awaking from a protracted sleep, lost memory of all she had before learned. "Her memory was capacious and well stored with a copious stock of ideas. Unexpectedly, and without any forewarning, she fell into a profound sleep, which continued several hours beyond the ordinary term. On waking, she was discovered to have lost every trace of acquired knowledge. Her memory was *tabula rasa*—all vestiges, both of words and things, were obliterated and gone. It was found necessary for her to learn everything again. She even acquired, by new efforts, the art of spelling, reading, writing and calculating, and gradually became acquainted with the persons and objects around, like a being for the first time brought into the world. In these exercises she made considerable proficiency. But, after a few months, another fit of somnolency invaded her. On rousing from it, she found herself restored to the state she was in before the first paroxysm; but was wholly ignorant of every event and occurrence that had befallen her afterward. The former condition of her existence she now calls the old state, and the latter the new state; and she is as unconscious of her double character as two distinct persons are of their respective natures. For example, in her old state she possesses all the original knowledge, in her new state only what she acquired since. In the old state she possesses fine powers of penmanship, while in the new she writes a poor, awkward hand, having not had time or means to become an expert."*

Dismissing for the moment all that relates to the alternation of the two personalities, we see that there have been formed here two perfect memories entirely independent of each other. It is not alone the memory of personal facts, the fully conscious memory,

* Macnish, "Philosophy of Sleep."

that is cut into two parts which never reunite, and which have no cognizance of each other: the same lot befalls the semi-organic, semi-conscious memory which serves us in speaking, in reading, and in writing. We are not informed whether this dissection of memory extended also to its purely organic forms, the habits,—whether the patient for instance had to learn anew how to use the hands for every-day offices, as in eating, putting on clothes, and the like. But even though we suppose this group to have remained intact, the separation into two distinct and independent groups is so complete as to satisfy the most exacting observer.

Dr. Azam recounts a case resembling this, but far less clearly defined. The normal memory disappears, and reappears periodically. In the interval no new memory is formed, but the patient retains a beggarly remnant of his old memory: such at least is the inference to be drawn from the record of an observation whose psychological details are not always very accurate.* The case was that of a youth who, having been subject to chorea, lost all memory of the past, forgot all that he had ever been taught, could no longer read, nor write, nor count, and recognized none of the persons around him except his father, his mother, and the nun who attended him. Yet while the amnesia lasted—and usually its term was a month—the young man could ride on horseback, drive a carriage, lead his accustomed life, and say his prayers very regularly at the proper times. Memory usually came back suddenly. So far as we may judge, there was in this case a periodic suspension of the memory in its unstable and semi-stable—or conscious and semi-conscious—forms (consciousness being as a rule in ratio inverse to stability). But whatever had to do with organized memory remained intact: the lowermost strata of memory stood firm. I will not, however, dwell upon a case which has not been reported with sufficient details to warrant a psychological interpretation.

II.—A second and less complete, but more frequent form of periodic amnesia is that so interestingly described by Dr. Azam, in the case of *Félida X.*, and of which Dr. Dufay found the analogue in the case of one of his patients. These cases are so well known, and the original narratives so accessible, that a brief summary of them will suffice here.

A woman subject to hysteria was in 1856 attacked by a singular disease in consequence of which she thereafter led a two-fold life, passing alternately from one to another of two states, designated by Dr. Azam, as the "first" and the "second" state. In her normal ("first") state, she was grave, seri-

ous, reserved, industrious. Suddenly she would fall asleep, lose consciousness, and on returning to herself, she was found to be in the second state. Her character is now altered. She is gay, talkative, imaginative, coquettish. "She remembers perfectly all that occurred in other like states before, as well as what occurred in her normal state." Then after a longer or shorter period she again falls into a stupor. On coming out of this she resumes her first state. But now she has forgotten all that occurred in her second state, remembering only the occurrences of her prior normal states. I may add that as she grows older the periods of the normal state became shorter and shorter, and farther apart, and the transition from one state to the other now takes place instantaneously, whereas before it used to take ten minutes.

Such are the main features of this case. So far as it concerns our particular inquiry, it may be summed up in a few words. The patient passes alternately from one state to the other; in the one, she possesses all her memory; in the other, she has but a partial memory covering all states of the same kind.

The case observed by Dr. Dufay, at Blois, is very like this. During the period answering to *Félida's* "second state," Dr. Dufay's patient "recollects the most trifling occurrence of her normal or of her somnambulistic state." There is also the same alternation of character, and in her period of perfect memory she speaks of her normal state as the "état bête"—the "brute state."

It is important to observe how, in this form of periodic amnesia, one portion of the memory is never affected but persists through both states. "In both states," says Dr. Azam, "the patient can read, write, count, and use the scissors or the needle as well as ever she could." There is not, as there was in the case cited by Macnish, a perfect scission between the two states: the semi-conscious states of memory are equally active in both.

III.—To complete our exposition of the different modes of periodic amnesia we will describe certain cases which present only some of its elements; they are seen in somnambulism, whether natural or induced. As a rule, somnambulists, on coming to themselves, have no recollection of what they said or did, but each crisis brings back the recollection of the preceding crisis. There are exceptions to this law, but they are rare. Macario's narrative has often been cited, of a girl who having been violated during a fit of somnambulism, had no cognizance of the fact on awakening, but who in her next somnambulistic state made it known to her mother. Dr. Mesnet witnessed a patient's attempt at suicide made with a good deal of judgment during two consecutive fits of somnambulism. A young maid servant every evening for three months thought she was a bishop, acting and speaking in that character; and Hamilton speaks of a poor apprentice who as soon

* "Revue Scientifique," 22 Dec., 1877. For instance, it is there said that during one of the attacks the patient "could converse intelligently and with animation, though he had not recovered his memory." (?)

as he fell asleep believed himself to be the father of a family, wealthy, a senator: every night he would recount his story in due order, in a loud voice, and if any one asked him about his apprenticeship, he would say that he was no apprentice. But it is useless to multiply examples; they exist in abundance, and they all show that side by side with the normal memory there is formed, during paroxysms, a partial, temporary, parasitic memory.

In summing up the general characters of periodic amnesia as exhibited in the phenomena, we find in the first place the *formation of two memories*.

In the perfect form of periodic amnesia (*e. g.*, Macnish's case) the two memories are mutually exclusive—the one appearing, the other disappears. Each suffices for itself; each has, so to speak, its own outfit. That organized memory whereby we are able to speak, write, read, is not common to the two states, but for each state there is formed a distinct memory of words, and of graphic signs, and of the mode of tracing them.

In the incomplete form (cases reported by Azam and Dufay, also in somnambulism) there is alternating with the normal memory a partial memory. The former includes all the states of consciousness; the latter only a restricted group of states which separate themselves from the others, and form in the life of the individual a series of fragments linked together. But the two memories have a common ground in the less stable, less conscious forms of memory, which enter equally into both groups.

The result of this scission of the memory is that the individual seems to himself, or at least to others, as though he led a two-fold life—a natural illusion, for the Ego consists (or seems to consist) in the possibility of associating with present states—states that are recognized, *i. e.*, localized in the past, according to processes which we have striven to describe. Here we have two distinct centers of association or attraction, each attracting one group of facts, and in no wise affecting other groups.

It is evident that this formation of two memories, each totally or partially excluding the other cannot be a normal fact. It is the symptom of a morbid process—the psychic expression of a disorder, the nature of which remains to be determined. And this leads us, much to our regret, to treat in an incidental way a large question—that of the conditions of personality.

First, we must lay aside the idea of an Ego regarded as an entity distinct from states of consciousness. Such hypothesis is both useless and self-contradictory; it is an explanation worthy only of a psychology in its infant state, that takes that to be simple which so appears, and which invents instead of explaining. I accept the opinion of con-

temporary scholars who recognize in the conscious person a something composite, a resultant of highly complex acts.

The Ego, as it appears to itself, consists of a sum of states of consciousness. There is a principal state of consciousness around which secondary states are grouped and which these tend to supplement, they themselves being in turn pressed by other states that are hardly states of consciousness at all. The state which acts the principal part, after a longer or shorter contest, gives way, being displaced by another around which we have another similar grouping. The mechanism of consciousness may be compared, without any metaphor, with that of vision. In the latter there is a visual *point* which alone gives a clear and definite sense perception; round about this is a *field* of vision which grows less and less clear and definite in proportion as it recedes from the center and approaches the circumference. Our Ego is at each moment—that present that is ever being renewed—in great part re-constituted by memory; that is to say, to the present state are associated other states which, being thrown back into and localized in the past, constitute our personality as it appears at each moment. In a word, the Ego may be considered in two ways—either in its actually present state, and then it is the sum of our actually present states of consciousness; or in its continuity with the past, and then it is formed by memory according to a process we have already described.

From this it might appear as though the identity of the Ego rested entirely on memory; but that view takes note only of a part of the facts. Under the instable compound that is each moment forming, breaking up, and forming again, there stands something that persists, *viz.*, that dim consciousness which is the result of all the vital actions, which constitutes our perception of our own bodies, and which has been designated by one word—*cœnæsthesis*. Our apprehension of it is so vague that it is difficult to speak of it in precise language. It is a state which, being perpetually repeated, makes no special impression on consciousness, and is like a habit. But though it is felt neither in itself nor in the gradual variations which constitute the normal state of the organism, it sometimes undergoes instantaneous or rapid variations which change the personality. All alienists teach that the incubation period of mental diseases is indicated not by intellectual disturbance, but by changes in *character*—and character is simply the psychic aspect of *cœnæsthesis*. So, too, we know that an organic lesion may transform the *cœnæsthesis*; substituting for the ordinary sense of existence a feeling of sadness, distress, anxiety, without cause, as the patient supposes; or again it may inspire feelings of gladness, satisfaction, buoyancy, perfect contentment—deceptive indications of grave

disorganization, the most striking illustration of which is seen in what has been called the euphoria of the dying. All these changes have a physiological cause; they represent its echo in the consciousness; and to say that while these variations are felt the normal state is not felt, is in effect to affirm that our normal life is not a mode of living because it is monotonous. This *cœnæsthesis* which, just because it is perpetually repeated, lies below the plane of consciousness is the true basis of personality. And it is so because, being always present, always active, without rest or respite, it knows neither sleep nor fainting, and endures as long as life itself, of which indeed it is but one form. This it is which serves as the ground of the conscious Ego constituted by memory; it is this which makes associations possible and when formed maintains them.

Hence the unity of the Ego is not a mathematical point, but that of a highly complex mechanism. It is a consensus of vital processes coordinated first by the nervous system, the great coordinating agency of the organism, and then by the consciousness, whose natural form is unity. It is in fact of the very nature of psychic states that they can coexist only in a very small number, grouped round one principal state which alone represents consciousness in its fullness.

Suppose, now, that we could instantly change our body and put another in its place—skeleton, vessels, viscera, muscles, all new except the nervous system, which remains the same, with all its past duly registered. There is no doubt but that in such case the afflux of unwonted life-sensations would produce the greatest confusion. Between the old *cœnæsthesis*, impressed on the nervous system and the new *cœnæsthesis* acting with the intensity of everything new and unwonted, there would be irreconcilable opposition. This hypothesis is realized to a certain extent in morbid cases. Some obscure organic trouble occasionally so modifies the *cœnæsthesis* that the subject believes himself to be made of stone, or butter, or wax, or wood; that he is of the opposite sex, or that he is dead. But apart from morbid cases, consider what takes place at puberty: "When certain parts of the body that before were inactive assume the active state, a complete revolution takes place in the organism. A mass of new sensations, new desires, new imaginings, more or less distinct, new impulses come into the consciousness in a relatively brief space of time. Little by little they penetrate within the circle of the thoughts of longer standing, and form an integral part of the Ego. The latter becomes a different being: it is transformed, and the feeling of its self-hood undergoes a radical metamorphosis. Until assimilation is complete, this penetration and this dissociation of the primitive Ego can hardly be brought about without great commotion of the consciousness and tumultuous

disturbance."* It may be affirmed that whenever changes in the *cœnæsthesis*, instead of being insensible or temporary, are rapid and permanent, discord arises between the two elements that constitute our personality in the normal state—the general sense of our body (*cœnæsthesis*) and conscious memory. If the new state holds its own, it becomes a center round which new associations group themselves; thus is formed a new complex, a new Ego. The antagonism between these two centers of attraction—the old, which is tending to dissolution, and the new, which is in process of development—produces different results according to circumstances. Sometimes the original Ego disappears, after enriching the new with its accumulated acquisitions, that is, with a portion of the associations of which it consisted. Again, the two Egos alternate, neither supplanting the other. Sometimes the original Ego exists no longer save in memory, but not being connected with any *cœnæsthesis*, it appears to the new as something extraneous.†

The object of the foregoing digression was to assign logical ground for what had before rested on mere assertion; namely, that periodic amnesia is only a secondary phenomenon; its cause is to be found in a vital disturbance, the general sense of existence (*cœnæsthesis*) which, properly speaking, is simply the sense of the unity of our body, passing through two alternate phases. This is the prime cause which produces the formation of two association-centers, and consequently of two memories.

Pursuing our investigation further, other questions meet us, to which unfortunately we can make no reply.

1. What is the physiological cause of these rapid and regular variations of *cœnæsthesis*? Only hypothetical replies have been offered (state of the vascular system, inhibitory action, etc.).

2. Why is each form of *cœnæsthesis* connected with certain forms of association, to the exclusion of others? We do not know, and can only say that in periodic amnesia the retention of impressions remains intact; that is to say, the cell modifications and dynamic associations remain; the power of recalling them is alone affected. The associations have two starting points: one state (A) may call out certain groups, but is incapable of awakening other groups; another

* Griesinger, "Traite des Maladies Mentales," p. 55, *et seq.*

† Thus I explain a case mentioned by Leuret ("Fragments psych. sur la folie," p. 277). An insane woman who spoke of herself as "*la personne de moi-même*" ("The person of myself"), had retained a very distinct memory of her life down to the beginning of her insanity, but she referred that period of her life to another person. Of her former Ego nothing but the recollection remained. Much might be said of such confusion of personality, but the discussion would take us beyond the subject we are treating.

state (B) does the reverse. Some groups enter equally into both complexes (incomplete scission).

In short, two physiological states, by their alternation, determine two *cœnæstheses*, and these determine two forms of association, and consequently, two memories.

To complete our observations on this subject, it is well to refer briefly to the natural connection established, in spite of interruptions, sometimes of considerable duration, between periods of the same kind, and particularly between different fits of somnambulism. This fact, interesting as it is on several accounts, can be considered here only so far as it exhibits a periodical and regular return of the same recollections. Abnormal as it may at first appear, it is entirely logical and in full agreement with our conception of the Ego. For if the Ego at each instant is but the sum of the actual states of consciousness and of the vital processes in which consciousness has its root, it follows that every time that this physiological and psychological complex shall be constituted, the Ego will be the same and the same associations will be called up. In each attack a special physiological state is produced; the senses are closed to nearly all external excitations, and consequently many associations can no longer be awakened. There is a simplification of the mental life: it is reduced almost to a mechanical condition. These states, by their very simplicity very closely resemble one another, and differ totally from the waking state. It is, therefore, natural that the same conditions should produce the same effects, that the same elements should give rise to the same combinations, and that the same associations should be awakened to the exclusion of others. They find in the pathological state their conditions of existence, which in the normal state either are wanting, or are in antagonism with many other conditions.

In the state of health and in the waking state the phenomena of consciousness are so varied, so numerous, that the same combination has little chance of being awakened many times in succession, though in certain abnormal cases this is seen to occur, under the action of unknown causes. A clergyman, says Dr. Reynolds, apparently in good health, went through the pulpit service one Sunday morning with perfect consistency, his choice of hymns and lessons, and his extempore prayer being all related to the subject of the sermon. The Sunday following he went through the service in precisely the same manner, selecting the same hymns and lessons, making the same prayer, giving out the same text, and preaching the same sermon. On descending from the pulpit he had not the slightest remembrance of having gone through precisely the same service on the preceding Sunday. He was much alarmed,

and feared an attack of brain disease, but nothing of the kind supervened.*

A like return of memory sometimes occurs in drunkenness, as in the well-known case of the Irish porter, who, having lost a package while drunk, got drunk again, and remembered where he had left it.

As has been already said, cases of periodic amnesia, curious though they may be, teach us more as to the nature of the Ego than as to the nature of memory. Still they are instructive, and we will return to them in the next paragraph.

III.

Progressive amnesia is that form which by a slow and continuous process of dissolution leads to complete abolition of memory. This definition applies to the majority of cases, and it is only in exceptional instances that the morbid evolution fails to result in total extinction. The process of the disease is very simple and does not impress the imagination, precisely because it is gradual, but it is highly instructive because, in showing how the memory is disorganized, it teaches us how it is organized.

Here we are not called upon to cite special cases of rare occurrence or of exceptional character. It suffices to describe just one morbid type that is very nearly constant.

The primary cause of the disease is some progressive lesion of the brain—cerebral hemorrhage, apoplexy, softening of the brain, general paralysis, senile atrophy and the like. In the early stages there exist only partial disorders. The patient is subject to frequent moments of forgetfulness, always with respect to *recent* occurrences. If he drops the work he happens to be doing, he forgets to take it up again. The events of yesterday and the day before, the order he has received, the resolution he has taken—all are blotted out at once. This partial amnesia is the habitual symptom of incipient general paralysis. Lunatic asylums are full of patients belonging to this category who, the day after they are received, declare that they have been a year, five years, ten years in the institution. They have only a faint remembrance of having left their homes and families; they cannot tell the day of the week nor the month of the year. But their memory of what they did and what they learned before the onset of the disease is still intact. It is a familiar observation that in aged persons the characteristic failure of memory has reference to recent occurrences.

That is about as far as the data of the received psychology go. The conclusion would seem to be that the dissolution of memory does not follow any law. I will offer proof to the contrary.

To discover the law we must make a psychological study of the progress of demen-

* *Apud*. Carpenter, *op. cit.*, p. 444.

tia.* When the premonitory stages, of which we have spoken, are past, there supervenes a general and gradual enfeeblement of all the faculties, till at last the individual is reduced to a purely vegetative life. Physicians distinguish several species of dementia, as senile, paralytic, epileptic, etc., according to the cause which produces it. These distinctions do not concern us. The break-up of the mind is always the same thing whatever the cause may be, and in it alone are we interested. The question therefore is, in this breaking up of the mind, does the loss of memory proceed in a fixed order?

The many alienists who have described dementia have not dwelt on this question, as it has no importance for them. Their testimony, therefore, will be all the more valuable if we can find an answer in their writings: and we do. On consulting the best authors (Griesinger, Baillarger, Falret, Foville, etc.,) we learn that the amnesia, at first restricted to recent events, later extends to ideas, then to feelings and affections, and finally to acts. Here we have all the data of a law. To determine what the law is we have only to examine successively these several groups.

1. That the weakening of the memory first affects the recollection of recent events is an observation so familiar that we fail to notice how it contradicts our *a priori* ideas. One would suppose that the most recent occurrences, those nearest to the present would be the most stable, the most distinctly remembered, and such is in fact the case in the normal state. But at the setting in of dementia there occurs a serious anatomical lesion—the degeneration of the nerve cells begins. These elements, tending to atrophy, can no longer retain new impressions. In more precise language, no new modification of the cells, and no formation of new dynamic associations is possible, or at least durable. The anatomical conditions of stability and reviviscence are wanting. If the perception is entirely new, it is not registered in the nerve centers and is instantly blotted out. If it is only a repetition of prior experiences that are still vivid, the patient refers the perception to the past; the concomitant circumstances of the actual perception are quickly effaced, and cannot be localized in time. But the modifications fixed years before in the nerve elements and now become organic; the dynamic associations and groups of associations that have been repeated hundreds and thousands of times, still persist; they have greater power of resistance to meet destructive forces. Thus is explained the paradox of memory, that the new dies before the old.

2. Soon this old-time store of organic and conscious memories, on which the patient for a time subsists, is in turn dissipated. His intellectual acquisitions are lost, one after

another (scientific, artistic, professional knowledge, languages, etc.). His personal recollections fade away, those of later years first, those of childhood last. When the process of decay is in an advanced stage, the stories and ditties of childhood even return. Often the demented forget in great part their own language. A few expressions are remembered by accident, but commonly the patient repeats automatically the words he retains. The anatomical cause of this intellectual dissolution is an atrophy which, little by little, invades the cortex of the brain, and the white matter, producing a fatty and atheromatous degeneration of the cells, tubes and capillaries of the nerve-substance.

3. It has been noticed by the best observers that the affectional faculties are extinguished far more slowly than the intellectual. It may at first seem strange that states so vague as those of feeling and sentiment should be more stable than ideas and intellectual states in general. But reflection shows that the feelings are the deepest, the inmost, the most persistent features of our mental constitution. Whereas the intelligence is something acquired and as it were external to us, the feelings are inborn. Considered in their origin, aside from any refined and complex forms they may assume, they are the direct and permanent experience of our organism. The viscera, muscles, bones—every tissue of our bodies contributes its share toward their formation. What are we but our feelings and sentiments? to forget them is to forget ourselves. Hence amnesia of the feelings must naturally occur only at a period when disorganization has gone so far that the personality begins to break up.

4. The acquisitions that longest withstand dissolution are those which are almost entirely organic—the daily routine, habits to which we have long been addicted. Many patients can arise in the morning, dress themselves, take their meals regularly, go to bed, engage in manual labor, play cards and other games, sometimes with remarkable skill, though the judgment, the will, the affections are extinguished. This automatic activity, which presupposes only a minimum of conscious memory, belongs to that lower form of memory for which the cerebral ganglia, the medulla and the spinal cord suffice.

The progressive destruction of the memory therefore follows a logical course, a law. *It descends progressively from the instable to the stable.* It begins with the recent recollections which, being but faintly impressed on the nerve elements, seldom repeated, and consequently but feebly associated with other recollections, represent organization in its lowest stage. It ends with that sensorial, instinctive memory which, being rooted in the organism and become a part of it, or rather become the organism itself, represents organization in its most pronounced aspect. From the initial to the final term the progress

* The term is used here in its medical sense, not as a synonym of insanity in general.

of amnesia, determined by the nature of things, follows the line of least resistance, that is, of least organization. Thus pathology fully bears out what we have said with regard to memory. It is a process of organization in varying degrees between two extreme limits: the new state, organic registration.

This law, which I shall call the Law of Regression or of Reversion, seems to rest on facts and to be objectively true. Still, to remove all doubt and to obviate every objection, I propose to verify this law by a counter demonstration.

If memory, when failing, follows invariably the course indicated, then it must follow the reverse course when it is in process of restoration: the forms that disappear last must reappear first, for they are the most stable; and the process of restoration must be an ascending one.

It is very difficult to find cases in proof. In the first place the memory must return of its own accord: cases of re-education prove but little. Again, recovery from progressive amnesia is of rare occurrence. Finally, as attention has never been directed to this point, nothing is to be found upon it in the books. Physicians, whose attention is engrossed with the other symptoms are content to observe that memory "returns little by little."

Louyer-Viller in his essay, quoted above, observes that "memory when in process of re-establishment, follows an order inverse to that followed when in decay: events, adjectives, substantives, proper names." But little is to be drawn from this not over-precise remark.

Here is something more definite: "Late-ly a celebrated Russian astronomer forgot, successively, the events of the previous day, then those of the year, then those of the years last past, and so on, the chasm gradually increasing, till at last he could only recollect the events of his childhood. His case was considered hopeless; but by a sudden stop and unforeseen return, the blank was filled up in an inverted manner; the events of his youth first reappearing, then those of his manhood, and finally the more recent, those of the previous day. His memory was wholly restored at the time of his death."*

The following observation is still more to the point: the facts were noted in this instance hour by hour. I quote the greater part of the narrative: †

"I must in the first place mention two details of no great importance in themselves, but which need to be noted because they are connected with a remarkable phenomenon. Toward the end of November, an officer of

my regiment suffered an injury to the left foot from the chafing of the boot. On November 30 he went to Versailles to visit his brother. He dined in Versailles and in the evening went back to Paris, and on entering his lodging found on the mantelpiece a letter from his father.

"Now for the principal fact. On December 1 this officer was at the riding school, and his horse having fallen, he was thrown to the ground, falling on his right side, particularly on his right parietal bone. The concussion was followed by a slight syncope. Coming to himself he mounted his horse again 'to get rid of a trace of giddiness,' and continued his lesson in horsemanship for three-quarters of an hour. Still he would now and then remark to the groom, 'I am coming out of a dream. What is the matter with me?' He was taken to his lodging.

"As I lived in the same house, I was summoned immediately. He was standing as I entered, recognized me, saluted me as usual, and said, 'I am like one coming out of a dream: what is the matter with me?' His utterance was unimpeded. He answered all questions rationally. He complained only of a buzzing in his head.

"Though questioned by myself, his groom and his servant, he remembered neither the injury of two days before, his journey to Versailles on the day before, his leaving the house in the morning, his orders to his domestic on going out, his fall, nor anything that followed thereafter. He fully recognized his friends, called each by name, knew that he was an officer, knew the day of the week, and so on.

"I never allowed an hour to pass without noting his condition. At every call, he always thought I had come then for the first time. He remembered none of the prescriptions he had been following—footbaths, friction, etc.; in short for him nothing existed but the action of the present moment. Six hours after the accident his pulse commenced to grow quicker and he began to retain in mind the answer so many times made to his question—'You had a fall from your horse?' Eight hours after the accident, his pulse still rising, he remembered having seen me there-once. Two hours and a-half later, the pulse being normal, he forgot nothing that was said to him. He then distinctly recollected the injury to his foot; and was also beginning to remember his visit to Versailles, but this in so uncertain a way that were any one to declare positively the contrary, he would have been inclined to believe him. But memory coming back more and more, he became assured during the evening that he had been at Versailles. There the progress for that day stood still. When he went to sleep, he was still unable to remember what he had done at Versailles, how he had come back to Paris, or where he had found the letter from his father.

* Taine, "Intelligence," Part 1, Bk. ii, ch. ii.

† "Observation sur un cas de perte de Mémoire," by Kœmpfen in the "Mémoires de l'Académie de Médecine," 1835, vol. iv, p. 489.

"On December 2, after a night of untroubled sleep, as soon as he awoke, he recalled in succession what he had done at Versailles, and his finding the letter on the mantelpiece. But he still knew nothing of what he had done, or seen, or heard, on December 1, prior to the accident—that is to say, he knew nothing of his own knowledge, but only what he had heard from others.

"The loss of memory was in the inverse ratio of the time that had elapsed between the several occurrences and his fall, and the return of memory was distinctly in the order from the more remote to the more recent."

This observation, made without any intention of bolstering up any hypothesis by a man who seems much surprised by the facts he records, strongly confirms our law of regression. True, this was only a case of temporary, limited amnesia; but it is seen that even within these narrow limits the law is verified. I regret that though I have searched a good deal, and made inquiries in many quarters, I am unable to lay before the reader many other cases of this kind. But when attention has been called to the matter, I hope other cases will come to light.

Our law, therefore, resting as it does on facts, and verified by this counter proof, may be held to be true till the contrary is shown. Then there are other considerations that go to corroborate it.

This law, however universal it may be with regard to memory, is but a particular expression of a still more general law—a biological law. It is a fact well known in biology that the structures that are latest formed are the first to degenerate—a fact, says a physiologist, analogous to what takes place in great commercial crises. The old houses withstand the hurricane, the new ones, less firm, are brought down on all sides. Again, in the biological world, dissolution proceeds in an order inverse to that of evolution—it proceeds from the complex to the simple. Hughlings Jackson was the first to prove in detail that the higher, complex, voluntary functions of the nervous system disappear first, and that the lower, simple, general and automatic functions disappear latest. We have seen both of these facts verified in the dissolution of the memory: what is new dies out earlier than what is old, what is complex earlier than what is simple. The law we have formulated is therefore only the psychological expression of a law of life; and pathology in turn exhibits to us in memory a biological fact.

The study of periodic amnesia has thrown new light on our subject. In teaching us how memory is constituted and how destroyed, it shows what memory is. It has revealed to us a law by which we may guide ourselves through the multitudinous varieties of diseases of memory, and which will later enable us to view them as one whole.

Without attempting a premature summary we may recall what has just been said: First

of all, and in every case, there is loss of recent recollections; in periodic amnesia there is a suspension of all the forms of memory except the semi-organized and the organic; in total temporary amnesia there is complete abolition of memory, except the organic forms; in one case, that described by Macnish, there is complete abolition, including the organic forms. We shall see in the next chapter that partial disorders of memory are governed by the same law of regression, especially that most important group, amnesia of language.

The law of regression accepted, we have next to determine how it acts. On this point I shall be brief, as I have nothing to offer but hypotheses.

It were puerile to imagine that recollections are deposited on the brain in layers in the order of their priority in time, after the manner of geological strata; and that disease, descending from the surface down to the deep-lying layers, acts after the manner of the experimentalist who removes slice after slice from the brain of an animal. To explain the course of the morbid process we must have resource to the hypothesis offered above with respect to the physical bases of memory. I will state it again in a few words:

It is in the highest degree probable that recollections have the same anatomical seat as the primary impressions and that they call into action the same nerve-elements (cells and fibers). These elements may occupy very diverse positions—from the cortex of the brain to the medulla. Retention and reproduction depend, 1. On a certain modification of the cells; 2. On the formation of more or less complex groups, which we denominate dynamic associations. Such are the physical bases of memory as we conceive them.

The primary acquisitions—those dating from infancy—are the simplest, namely, the formation of automatic secondary movements, and the education of our senses: they depend principally on the medulla and on the inferior centers of the brain; and as we know, the cortex is at this period of life imperfectly developed. Quite apart from their simplicity, there is every reason why they should be the most stable. In the first place the nerve-elements, when they receive these primitive impressions, are "virgin." Nutrition is in infancy very active, but this incessant molecular renovation serves only to fix the impressions, the new molecules take exactly the places of the old, and hence the acquired disposition of the nerve-elements becomes in the end equivalent to an innate disposition. Further, the dynamic associations established between these elements attains a state of perfect fusion, from being repeated innumerable times. Hence it is inevitable that these first acquisitions should be better retained and more easily reproduced than any others, and that they should constitute the most enduring form of memory.

So long as the adult individual remains in the state of normal health, his new impressions and new associations, though far more complex than those of childhood, are nevertheless very likely to be stable. The causes we have just enumerated are ever operative, though with less force.

But if through the effects of old age or of disease the conditions are changed; if the vital actions, and in particular nutrition, are weakened; if the loss exceeds the gain; then the impressions become instable and the associations are easily broken up. Take an example. Suppose a man in that stage of progressive amnesia in which recent events are very soon forgotten. He listens to a narrative, he views a landscape, or sees a show. The psychic fact is in the last analysis reduced to a sum of auditive or visual impressions forming highly complex groups. In the new story or the new show there is usually only one thing that is new—the grouping, the association. The sounds, forms, colors that make them up have been many a time experienced, and many a time remembered before. But now, owing to the morbid condition of the brain, this new complex of impressions fails to fix itself in the brain; the elements that constitute it are part of other associations or groups of far more stable character, that were formed in the period of normal health and that have been oft repeated.

The strife is very unequal between the new complex that weakly tends to establish itself in the nerve centers, and the older complexes that are firmly established. Hence all the chances are that the old combinations will be called up later, instead of the newer one. These hints must suffice. For the rest, this hypothesis as to the cause of progressive amnesia is only of secondary importance. Accepted or rejected, it in no wise affects the value of our law.

IV.

There is but little to be said of *congenital* amnesia. I will refer to it, so that nothing may be omitted. It is seen in idiots, in imbeciles, and in a minor degree in crétins. Most of the patients are afflicted with a general debility of memory. It varies according to individuals, and in some may be such as to render impossible the acquisition and retention of the simple habits which constitute the daily routine of life.

But though a general debility of memory is the rule, frequent exceptions occur in practice. Among these classes of patients there are some individuals who possess a very remarkable power of memory, within a restricted field.

It is often observed in idiots and imbeciles that their several senses are affected in very different degrees. Thus, the hearing may be extremely acute and discriminating while the rest of the senses are dull. The arrest of

development is not uniform at all points. Hence it is not surprising that debilitation of the general memory should coincide, in the same man, with the evolution or even the hypertrophy of a special memory. Thus some idiots, refractory to all other impressions, have a strong liking for music, and can remember an air they have heard only once. Others—and these cases are more rare—have memory of form and color, and show a certain skill in drawing. More frequently we find memory of numbers, dates, proper names, and words in general. “An imbecile remembered the date of every burial that occurred in a parish for thirty-five years. He could repeat with unflinching exactitude the names and ages of the deceased, as also of those who had conducted the funerals. Beyond this mortuary record he had not one idea; he could not answer the simplest question, he was incapable even of serving himself with his food.” Some idiots that are unable to make the simplest calculations, will repeat without a slip the multiplication table. Others will recite by heart whole pages that they have heard read from books, though they cannot name a single letter of the alphabet. Drobisch relates the following fact of which he was himself a witness: a boy of fourteen years, nearly idiotic, had great difficulty in learning to read; yet he remembered with wonderful facility the order in which the words and letters succeeded one another. Give him two or three minutes to go over a page printed in a language unknown to him, or treating of subjects of which he knew nothing, and he could from memory spell all the words there found, precisely as though the book lay open before him.* The existence of these partial memories is so common a fact that it has been turned to account in educating idiots and imbeciles.†

It is further to be remarked that some idiots subject to mania or other acute disorders regain a temporary memory. Thus, “an idiot, become a maniac, narrated a rather complex occurrence of which he had many years before been a witness, and which had seemed to make no impression upon him.”‡

In congenital amnesia it is the exceptions that are instructive. Our law simply confirms the commonplace truth that the memory depends on the constitution of the brain, and in idiots and imbeciles the brain is abnormal. But the formation of these limited, partial memories helps us to understand certain dis-

* Drobisch, “*Empirische Psychologie*,” p. 561. Dr. Herzen writes to me about a Russian, from Archangel, now twenty-seven years of age, who was stricken with imbecility at the close of a debauch. Of the brilliant faculties of his adolescence all that he retained was an extraordinary memory, so that he could instantaneously perform the most difficult operations in arithmetic or algebra, and repeat word for word long pieces of poetry after hearing them read only once.

† See Ireland's work “*On Idiocy and Imbecility*,” London, 1877.

‡ Griesinger, op. cit., p. 431.

orders of which we have not yet treated. I am inclined to believe that the methodical study of what occurs in idiots would enable us to determine the anatomical and physiological conditions of memory. We will return to this point in the next chapter.

CHAPTER III.

PARTIAL AMNESIA.

Reduction of memory to memories—Anatomical and physiological reasons for partial memories—Amnesia of numbers, names, figures, forms, etc.—Amnesia of signs—Its nature; a loss of motor-memory—Examination of this point—Progressive amnesia of signs verifies completely the law of regression—Order of dissolution: proper names; common nouns; verbs and adjectives; interjections and language of the emotions; gestures—Relation between this dissolution and the evolution of the Indo-European languages—Counter-proof: return of signs in inverse order

I.

Before we proceed to the consideration of partial amnesia we must first remark upon the *varieties* of memory. Without such preliminary remarks the facts we are about to state would appear inexplicable. That a man should lose only his memory of words, or should forget one language, retaining others, or that a language long forgotten should come back to him suddenly, or that he should be bereft of his musical memory and of that alone—these things are so odd and strange on first view that were it not that they are vouched for by the most scrupulous observers, they might well be relegated among fables. But if, on the other hand, we have a clear idea of what is meant by the word memory, the marvelous disappears, and these facts, so far from surprising us, appear as the natural, logical consequence of a morbid influence.

The employment of the word memory as a general term is perfectly correct. It designates a property common to all sentient and thinking creatures—the possibility of retaining impressions and of reproducing them. But the history of psychology shows that there is a tendency to forget that this term, like all other terms, has a real signification only in particular cases: that memory resolves itself into memories, just as the life of an organism resolves itself into the life of the organs, tissues, anatomical elements that compose it. "The ancient and still unexploded error," says Lewes, "which treats memory as an independent function, a faculty, for which a separate organ, or seat, is sought, arises from the tendency continually to be noticed, of personifying an abstract

tion. Instead of recognizing it as the short hand expression for what is common to all concrete facts of remembrance, or for the sum of such facts, many writers suppose it to have an existence apart.*

Though every-day experience has long noted the natural inequality of the different forms of memory in one and the same person, psychologists either have not interested themselves in that fact, or have denied it on principle. Dugald Stewart seriously maintains that "original disparities among men in this respect are by no means so immense as they seem to be at first view, and that much is to be ascribed to different habits of attention, and to a difference of selection among the various objects and events presented to their curiosity."† Gall, who was the first to make a stand against this tendency, ascribed to each faculty a memory of its own, and denied the existence of memory as an independent faculty.

Contemporary psychology, more careful than the old-school psychology to omit nothing, and more concerned about exceptions, that afford instruction, has brought to light a considerable number of facts which remove all doubt as to the natural inequality of the several memories in the same individual. Taine gives many excellent examples of this. We may cite in illustration Horace Vernet and Gustave Doré, painters, who can paint a portrait from memory; chessplayers who can carry on one or more games in mind; little calculating prodigies like Zerah Colburn who "see their sums before their eyes";‡ the man mentioned by Lewes who, after walking half a mile down a street, could name all the shops in their respective positions; Mozart writing the notes of the Sistine chapel *Miserere* after hearing it twice. For details I refer the reader to special treatises,§ as I have no occasion to discuss the question here. It is enough that the reader hold these inequalities of the memory for well established. Let us now see how they are explained; we shall then see what they themselves explain.

What is implied by these partial memories? Special development of a special sense with the anatomical structures dependent on it.

To make this clearer, take a particular case—for instance a good visual memory. This has for its condition a good structure of the eye, of the optic nerve, and of the portions of the brain which concur in the act of vision—that is to say (according to the received notions of anatomists) certain portions of the pons, the crura, the optic tract, and the

* *Op. cit.*, Vol. III, p. 119.

† "Philosophy of the Human Mind."

‡ I have had occasion to note that many calculators do not see their figures nor their sums, but that they "hear" them. So far as our theory is concerned it matters little whether the images are visual or auditive.

§ Taine, "Intelligence," vol. 1, part 1, Book II, ch. 1, § 1; Luys, "The Brain and its Functions;" Lewes, loc. cit.

hemispheres. These structures, higher by hypothesis than the average, are perfectly adapted to receive and to transmit impressions. Consequently the modifications which the nerve-elements undergo, as also the dynamic associations formed between them—and these, as we have often said, are the bases of memory—ought to be more stable, more definite, more easily revived, than in an ordinary brain. In short, to say that a visual organ has a good anatomical and physical constitution, is to say that it presents the conditions of a good visual memory.

We may go further, and say that the term "a good visual memory" is too broad. Daily experience shows us that one person recollects forms best, another person colors.

It is probable that the former's memory depends mainly on the muscular sensibility of the eye, that of the latter on the retina and the nervous apparatus connected with it.

These remarks apply to hearing, smell, taste, and those diverse forms of sensibility comprised under the general name of touch—in short, all sense perceptions.

If we reflect upon the close relations subsisting between the feelings, the emotions, the general sensibility, and the physical constitution of each individual, and if we consider how dependent these physical states are upon the organs of animal life, we shall understand that these organs bear the same relation to the feelings that the organs of sense do to sense perceptions. Through differences of constitution, the impression transmitted may be faint or strong, stable or transient: here are so many conditions to modify the memory of feelings and sentiments. The preponderance of any system of organs—those of generation for example—gives the superiority to one group of recollections.

There remain the higher psychic states—abstract ideas and complex sentiments. These cannot be referred directly to any organ: the seat of their production and reproduction has never been localized with precision. But as they no doubt result from an association or a dissociation of primary states, there is no ground for supposing that they are exceptional.

The foregoing remarks may be summed up thus. In the same individual an unequal development of the several senses and of the several organs produces unequal modifications in the corresponding parts of the nervous system, and consequently varieties of memory. It is probable even that inequality of memories in the same person is the rule, not the exception. As we have no exact processes for weighing and measuring them separately, and comparing them with one another, we offer the foregoing only as a conjecture. An indirect proof might be drawn from the antagonism between the different forms of memory: this is a point that might give occasion for much curious research, but

it is beside our subject. * Finally, no objection can be brought from the influence of education. Of course education counts for much, but it hardly does anything more than to foster what nature has already singled out; and in certain cases it has been unable to act any part.

In psychology, as in all sciences based on facts, experience decides in the last resort. We would remark however that the relative independence of the different forms of memory might have been demonstrative by reasoning alone. In fact it is a corollary of the two propositions following, viz.: 1, Every recollection has its seat in certain determinate parts of the brain; 2, The brain and the cerebral hemispheres themselves "consist of a number of organs totally differentiated, each one of which possesses a function of its own, though it remains most closely connected with the others." This latter proposition is now accepted by most authors who study the nervous system.

In physiology indeed the distinction of partial memories is now currently received,† but in psychology the method of "faculties" has succeeded so well in having the memory regarded as a unit that the existence of partial memories has been completely forgotten or has been taken for an anomaly. It was needful that I should bring the reader back to the reality and remind him that in the last analysis there exist only special, or as some authors say, local memories. We willingly accept this latter term provided it be borne in mind that we have to do here with a distributed localization, according to the hypothesis of dynamic associations already set forth. The memory has often been compared to a store-house where all our items of knowledge are kept in separate shelves. If this simile is to be retained it must be presented in a more active form—each particular memory would be compared to a squad of employees charged with a special and exclusive branch of business. One of these squads may be dropped without throwing all the rest into confusion. This is what occurs in partial disorders of memory.

After these preliminary observations, we proceed to study the pathology of memory. If in the normal state the different forms of memory are relatively independent, it is perfectly natural that in the morbid state one form should disappear, leaving the rest intact. This fact must appear to us now as simple, and needing no explanation, resulting as it does from the very nature of memory.

* On the antagonism of memories, see Herbert Spencer, "Principles of Psychology," vol. 1.

† See in particular Ferrier, "Functions of the Brain." Even Gratiolet "Anatomie Comparée," Vol. II, p. 460, remarked that "to each sense corresponds a memory that is correlative to it, and that the mind like the body has its temperaments which result from the predominance of a given order of sensations in the natural habits of the mind."

True, many partial disorders are not restricted to only one group of recollections. This will not excite surprise if we reflect on the close solidarity of all the parts of the brain, their functions and the psychic states therewith connected. Still we shall find a certain number of cases in which the amnesia is limited.

A complete study of partial amnesia would involve the examination, one after another, of the different manifestations of psychic activity, and proving from examples that each group of recollections may disappear, whether for a time or forever. We can by no means carry out that plan. We are unable even to say whether certain forms are never partially affected, and never disappear, save when there is total dissolution of the memory. We must look to the future for fuller or more conclusive pathological proofs.

Properly speaking there is only one form of partial amnesia that may be studied thoroughly—the amnesia of signs (whether spoken or written signs, interjections, gestures.) It is rich in all sorts of facts explicable by the law formulated in the preceding chapter. Leaving that for separate study, we will state what is known with regard to other forms of partial amnesia.

"Some persons," writes Calmeil, * "have lost the power of reproducing certain sounds, or certain colors, and have had to abandon music or painting; others lose only the memory of numbers, figures, a foreign language, proper names, or the existence of their nearest relatives." We offer a few examples.

The case of Sir Henry Holland, narrated by himself in his "Mental Pathology" (p. 160), has often been quoted: "I descended on the same day two very deep mines in the Harz Mountains, remaining some hours underground in each. While in the second mine, and exhausted both by fatigue and inanition, I felt the utter impossibility of talking longer with the German inspector who accompanied me. Every German word and phrase deserted my recollection: and it was not until I had taken food and wine, and been some time at rest that I regained them again."

This case, though the one best known is far from being unique. Dr. Beattie tells of a friend of his, who having received a blow on the head, lost all he ever knew of Greek, his memory in other respects appearing to be intact. This loss of languages that have been acquired by study, has often been noted as a result of sundry fevers.

"So as regards music. A child having received a severe blow on the head, was unconscious for three days. On coming to himself he had forgotten all the music he had learned; nothing else was lost." † Other cases are more complex. A patient who had forgotten

the values of the musical notes, was able to play a tune after hearing it. Another could write musical notes, even compose music and recognize a melody he heard executed; but he was unable to play with the notes before him.* These facts showing as they do the complexity of our mental operations, even of those which seem most simple, will be considered later.

In some cases the best organized recollections, the most stable, disappear instantaneously, while others presenting the same character remain intact. Thus Abercrombie tells of a surgeon who having been thrown from his horse and suffered an injury in the head, gave the minutest directions upon coming to himself as to his treatment. But he no longer remembered that he had a wife and children, and this forgetfulness lasted for three days.† Is this fact to be explained on the theory of mental automatism? This surgeon, though half insensible, remembers his professional knowledge.

Some patients lose entirely the memory of proper names, even their own. We shall see later, when we come to study the amnesia of signs, in its perfect evolution—as it is seen in the aged—that these proper names are always soonest forgotten. In the cases that follow, this forgetfulness was the symptom of softening of the brain.

A certain man, unable to recall the name of a friend, had to take his interlocutor to the door on which was a plate bearing the name. Another person, after an attack of apoplexy, was unable to recall the names of any of his friends, though he designated them correctly by their ages. Mr. von B., formerly Envoy to Madrid, and afterward to St. Petersburg, was about to make a visit, but could not tell the servants his name. "Turning round immediately to a gentleman who accompanied him, he said with much earnestness, 'For God's sake, tell me who I am!'" The question excited laughter, but as Mr. von B. insisted on being answered, adding that he had entirely forgotten his own name, he was told it, whereupon he finished his visit." ‡

In other instances an apoplectic attack is followed only by amnesia of *numbers*. A traveler after long exposure to cold experienced a great weakening of the memory. He could not himself make any calculation, nor retain for a moment any operation in numbers.

Forgetfulness of faces is frequent, nor need this excite surprise, for in the normal state many persons have this kind of memory very ill developed and very instable; besides, the memory of faces must be the result of a pretty complex mental synthesis. Louyer Villermay gives an amusing example:

* Kussmaul, "Die Störungen der Sprache," p. 181; Proust, "Archives générales de médecine," 1872.

† Abercrombie, "Intellectual Powers."

‡ Forbes Winslow, *op. cit.*

* "Dictionnaire en trente volumes," art. *Amnesie*.

† Carpenter, "Mental Physiology," p. 443.

"An old man being in the company of his wife imagined her to be a lady whom he had in the past been wont to visit every evening, and he would repeat again and again, 'Madam I cannot remain longer; I must return to my wife and children.'"

Carpenter tells us of a distinguished scientist whom he had known from childhood, that though turned seventy years of age he was still full of vigor, but that his memory was failing. In particular, he forgot recent occurrences and words in most frequent use. "Though continually at the British Museum, the Royal Society, and the Geological Society, he would be unable to refer to either by name, but would speak of 'that public place.' He still continued his visits to his friends, and recognized them in their own homes, or in other places (as the Scientific Societies) where he had been accustomed to meet them; but the writer, on meeting him at the house of one of the oldest friends of both, usually residing in London, but then staying at Brighton, found that he was not recognized; and the same want of recognition showed itself when the meeting took place out of doors. "The want of memory of words then showed itself more conspicuously, one word being substituted for another, sometimes in a manner that showed the chain of association to be (as it were) bent or distorted. Thus, he told a friend that 'he had had his umbrella washed,' the meaning of which was gradually discovered to be that he had had his hair cut. His memory steadily declined, and he died of apoplexy."*

In this instance there is seen simultaneously existing amnesia of proper names, and names of things, and amnesia of faces; but what is most curious is the part played by the law of contiguity. Recognition of persons is not spontaneous, suggested simply by their presence. To have recognition, it must be suggested or rather aided by the actual impression of the places where they habitually are. The recollection of these places, fixed by the experience of a life-time, and become almost organic, remains stable: it serves as a fixed point to call out other recollections.

The names of these "public places" is not revived: the association between the object and the sign is too faint. But the recollection of faces is in operation, being dependent on a stable sort of association, namely contiguity in place. The one category of association that has survived assists in reviving another category, which, left to its own resources, would not have been called up.

It were an easy thing, but profitless to the reader, to enumerate cases of partial amnesia. It is enough to have shown by a few examples wherein partial amnesia consists.

The question naturally arises whether the forms of memory which disease either dis-

organizes for good or only temporarily suspends, are the ones that are best established, or only the weakest. We cannot answer positively. Logically, it would seem that the morbid influences must follow the line of least resistance: and the facts appear to confirm this hypothesis. In most cases of partial amnesia it is the least stable forms of memory that are attacked. At least I do not know of a single case in which, any organic form being suspended or abolished, the higher forms have remained intact. Yet it were rash to deny that this has never occurred.

We may therefore only reply to the question with an hypothesis till we shall be in possession of fuller information. For the rest it would be contrary to scientific method to refer to one law all sorts of cases depending on special conditions. A thorough study of each case and its causes is necessary before we can declare them all to be reducible to one formula. Just now the problem is too obscure to permit of this being done.

The same remarks apply to the process by which these forms of amnesia are produced. In the first place we know nothing about the psychological mechanism special to each form. Here all means of explanation fail us. As regards the psychological mechanism we may venture an hypothesis. In the cases of partial amnesia we have been considering two things in particular worthy of note, viz., destruction and suspension. Destruction is the direct result of the disorganization of the nerve-elements. In the case of suspension a certain group of elements remains temporarily isolated and powerless, or, in psychological language, it stands outside of the mechanism of association. This explanation is suggested by the case cited by Carpenter. The solidarity existing between the different parts of the brain, and consequently between the different psychic states persists, as a rule. These groups alone, with the sum of recollections that they represent, are in a manner made immobile, inaccessible to the other groups, incapable for a time of entering into the consciousness. This state must be the result of psychological conditions which escape our notice.

II.

We have reserved for special study one form of partial amnesia—that of *signs*. Here we use the term *signs* in its broadest sense, comprising all the means man employs for expressing his feelings and thoughts. The subject is one that is clearly defined and rich in facts at once like and unlike, inasmuch as they possess a common physiological character in that they are signs, while they differ as to the nature of the signs, which are either vocal or written signs, gestures, drawings, or music. They are easily observed and of every-day occurrence, and well localized; and owing to their variety they are well suited for comparison and analysis. Besides, as we shall see, this species of par-

* *Op. cit.*, p. 545.

tial amnesia very strikingly confirms the law of the destruction of memory laid down in the preceding chapter in its most general form.

But first we must guard against a misunderstanding. The reader may suppose that we are about to study aphasia: but not so. In most cases, aphasia, it is true, implies a disorder of the memory, but it implies something more; and it is only with disorders of memory that we are concerned. The researches made during the last forty years upon the diseases of the faculty of language, have shown that under this one term, aphasia, are included cases that differ very widely from one another. The reason is that aphasia being, not a disease, but a symptom, varies according to the morbid conditions that produce it. Thus, some aphasic subjects are deprived of every mode of expression; others are able to speak but not to write, or *vice versa*; the loss of gesture is much less frequent. Sometimes the patient retains a pretty considerable vocabulary of vocal and graphic signs, but speaks and writes in counter-sense (paraphasia, paraphagia). Or he does not understand the signification of words whether written or spoken, though hearing and sight be intact, (word-deafness, word-blindness). Aphasia is either permanent or transitory: oftentimes, it is accompanied by hemiplegia. This hemiplegia—which nearly always attacks the right side—is in itself, quite apart from amnesia, an obstacle to writing.* These principal forms present varieties according to the individuals affected. From this, the reader may have some idea of the complexity of the question. Fortunately, we have not to discuss it here. Our task—and it is one of no little difficulty—consists in determining among these disorders of speech and of the expressive faculty in general, that which seems to belong to memory alone.

Plainly, we have nothing to do with cases where aphasia results from idiocy, dementia, or loss of memory in general; neither with cases where the power of transmission alone is impaired: thus a lesion of the *white* matter of the brain, in the neighborhood of the third left frontal convolution may impair the expressive faculty, the gray matter being intact.† But after these two causes are eliminated, the difficulty is hardly lessened, for aphasia usually occurs under quite other conditions. We will examine it under its most ordinary form.

There is no need to cite instances, which the reader may find everywhere. † Usually,

aphasia appears suddenly. The patient is unable to speak; if he tries to write, there is a like inability; at best he is able, with great difficulty, to trace a few unintelligible words. His physiognomy retains the look of intelligence. He strives to convey his meaning by gestures. For the rest, there is no paralysis of the muscles that serve to articulate words; the tongue moves freely. Such are the general traits, at least the ones which most interest us just now.

What has occurred in the psychic state of the patient, and, as regards the memory, what is it that he has lost? A little reflection suffices to show that amnesia of signs is a phenomenon of quite a special character. It is not to be compared to the forgetfulness of colors, sounds, a foreign language, or a period of life. It extends to all the activities of the mind, and so far forth it is general; and yet it is partial only, for the patient retains his ideas and his recollections, and is conscious of his own situation.

In our opinion, the amnesia of signs is above all a disease of the *motor memory*: that it is which gives it its special character and makes it assume for us a new aspect. But what is meant by "motor memory," an expression which may at first cause surprise? The matter has been so little studied by psychologists, that it is difficult to discourse of it clearly in a summary way, and it cannot be treated here at any length.

I have endeavored in another place,* though not with sufficient fullness, to show the psychological importance of movements, and to prove that every state of consciousness implies in some degree motor elements. But to confine ourselves to the matter in hand, I would remark that no one finds difficulty in admitting that our perceptions, our ideas, our intellectual acts in general are not fixed in us, and have no part in memory except there exist in the brain certain residua—modifications of nerve-elements and of the dynamic associations of those elements. On this condition alone are they retained and recalled. But the same must of necessity hold good for movements. The movements under consideration, those which take place in articulate speech, writing, drawing, music, gestures, can be retained and reproduced only on condition that there are motor residua, *i. e.*, according to the hypothesis so often set forth, modifications in the nerve-elements and dynamic associations between those elements. But whatever opinion one may adopt, if ought remained of a word spoken or written for the first time, it were impossible either to read or to write.

* In left-handed subjects of aphasia the hemiplegia is always on the left side.

† For cases of this kind, see Kussmaul, "Die Störungen der Sprache," p. 99.

‡ The literature of aphasia is so plentiful that a simple enumeration of works or memoirs would occupy several pages. For the psychological aspects, the reader may consult Trousseau, "Clinique Médi-

cale," vol. II; Fabret, art. "Aphasia" in "Dict. encycl. des sciences médicales," Proust, "Archives gén. de méd.," 1872; Kussmaul, *ubi supra*; H. Jackson, "On the Affections of Speech," in *Brain*, 1878, 1879-1880, etc.

* "Revue Philosophique," Oct., 1879; see also an excellent chapter of Maudsley's work, "Physiology of Mind."

The existence of motor residua admitted, we may understand the nature of sign-amnesia.

Our intellectual activity consists, as we know, in a series of states of consciousness associated according to certain relations. Each term of a series seems to the consciousness simple, but it is not so in reality. When we speak or think with anything like precision, all the terms of a series form couples, made up of the thought and its expression. In the normal state the fusion of these two elements is so complete that they form one, but disease shows that they can be dissociated. Further, the expression "couple" does not suffice. It is exact only for that portion of the human race that cannot write. When I think of a house, over and above the mental representation which is the state of consciousness proper, over and above the vocal sign which translates that thought and which seems to form one thing with it, there exists a graphic element that is almost as intimately blended with the thought, and which, when I write, becomes even predominant. Nor is that all: around the vocal sign, "house," are grouped, by a less intimate association, the vocal signs used in other languages with which I am acquainted—*maison, domus, Haus, casa*, etc. Around the graphic sign, "house," are grouped the graphic signs of those same languages. Thus we see that in an adult mind, each clear state of consciousness is not a simple unit, but a complex unit, a group. The mental representative, the thought, is, properly speaking, only the nucleus, around which are grouped signs more or less numerous which determine it.

This understood, the mechanism of sign-amnesia becomes clearer. It is a pathological state in which, the idea being intact or nearly so, a part of the signs or all the signs which translate it are temporarily or forever forgotten. This general proposition must be completed by a more detailed study.

1. Is it true that in aphasic subjects, thought subsists, while its verbal and graphic expression has disappeared?

I would remark that it is not incumbent on us to inquire here whether one can think without signs. The question we have to discuss is altogether different. The aphasic subject has for a long time been using signs: do his ideas disappear with the power of giving them utterance? The facts answer in the negative. Though authors are unanimous in declaring that aphasia, especially when it is of long standing and of a serious character, is always accompanied by a certain decline of mental power, there is no doubt that mental activity persists even when it has no other mode of expression but gestures. Instances abound, but I will cite only a few.

Some patients deprived only of a portion of their vocabulary, but unable to find the right word, substitute for it a paraphrase or a description. For "scissors" they will say

"what you cut with," for window, "what you see through." They will designate a person by the place he lives in, by his titles, his occupation, his inventions, the books he has written.*

In more serious cases we see patients playing cards with considerable caution and reflection: others again are able to superintend the management of their business. Thus we have a great proprietor mentioned by Trousseau, "who by means of signs intelligible to those around him directed the leases and deeds to be laid before him, pointed out modifications to be made in them, and in most cases these modifications were useful and based on sound judgment." A man who was totally deprived of the power of speech, sent to his doctor a detailed account of his trouble written by himself in very correct language, and in a very firm hand.

We have furthermore the testimony of patients themselves after their recovery. "I had forgotten all words," says one, "but I retained fully my consciousness and my will. I knew very well what I wanted to say, but could not. When you," (the physician), "asked me a question, I understood you perfectly; I made all sorts of efforts to reply, but it was impossible to recall the words."† Rostan, on being stricken suddenly so that he was unable either to speak or to write a single word, "analyzed the symptoms of his disease and sought to refer them to some special lesion of the brain, just as he would have done in a clinical lecture." Lordat's case is well known: "He was capable of arranging in his mind the matter of a lecture, of altering the distribution of the several headings; but when his thoughts had to be uttered in speech or in writing, it was found to be impossible, though there was no paralysis."‡

We may therefore regard it as proven that, all means of expression having disappeared, the intelligence remains almost intact, and consequently that the amnesia extends only to signs.

2. Does this amnesia depend, as we have said it does, especially upon the motor elements? When on a preceding page we endeavored to prove the necessary existence of motor residua, we did not examine the problem in all its complexity. We must return to it:

When we are learning to speak our mother tongue or a foreign language, certain sounds, acoustic signs, are registered in the brain. But that registration is only a part of the

* Very often the aphasic patient confounds words, and says "fire" when he means "bread," or even coins words that are unintelligible. But these disorders seem to me to be rather a language-disease than a disease of memory.

† Legroux, "De l'aphasie," p. 96.

‡ For the facts see especially Trousseau, *op. cit.* Lordat, who is a strong spiritualist, (*i. e.*, advocate of the doctrine of an immaterial principle or soul in man), has from these cases drawn conclusions favoring the independence of mind.

task, for we have to repeat these signs, to pass from the receptive to the active state, to translate these acoustic signs into vocal movements. This operation is at first very difficult, for it consists in co-ordinating movements that are very complex. We are able to speak only when these movements are readily reproduced, that is, when the motor residua have been organized.

In learning to write we fix our eyes on the copy; optic signs are thus registered in the brain; then, with much effort we strive to reproduce these by the motions of the hand. Here, too, there is co-ordination of very complex movements. We are able to write only when the optical signs are immediately translated into movements, that is, when the motor residua are organized.

The same is to be said of music, drawing, acquired gestures, (for instance, those taught to deaf mutes). The expressive faculty is more complex than it seems to be. Our thoughts and feelings have need of an acoustic (or optical) memory—a motor memory. Now, what is there to prove that it is precisely this motor memory that is affected in cases of amnesia of signs?

Consider the phenomena observable in most cases of aphasia. Present to the aphasic subject any familiar object, for instance a knife, and call it by some other name, as *fork*, *book*, etc.; he will contradict you. Pronounce the true name and he expresses assent by gesture. If you ask him then and there to repeat the name, it is but seldom that he will be able to do so. Therefore, he has retained not only the idea but also its acoustic sign; for this he recognizes among many other signs. But since he cannot translate it into speech, though his vocal organs are intact, it follows that the amnesia must affect the motor elements.

The same experiment may be made with regard to writing. Among aphasic subjects, who are not paralyzed, it leads to the same results. The patient retains the memory of the optical signs, but has lost the memory of the movements necessary for their reproduction. Some patients can copy, but when the original is taken from them they are helpless.

However, while I hold that motor amnesia exists in most cases, I do not claim that it is always present. In so complex a subject, it is best not to pronounce absolutely. When the aphasia is irremediable we sometimes find the patient forgetting the vocal or written signs, or recognizing them only with great difficulty and with much hesitation. In such cases amnesia is not restricted to the motor elements. Again, some aphasic patients can, as we have seen, repeat a word or copy it; others can read aloud, though they are unable to speak in conversation. This is an exceptional case (Falret, p. 618). On the other hand, many can read to themselves, though unable to read aloud. It has hap-

pened, though rarely, that an aphasic patient would utter spontaneously one portion of a phrase, and then be unable to continue. Brown-Séquard cites even the case of a physician who spoke in his dreams, though aphasic in the waking state. These facts, infrequent though they be, show that motor amnesia is not always absolute. It is with this form of memory as with all other forms: under certain exceptional circumstances it revives.

We may in passing note an analogy. The aphasic patient who succeeds in repeating a word exactly, resembles one who is unable to recall an occurrence save with the assistance of other persons: the psychological mechanism of the amnesia of signs is the same as for all other kinds of amnesia. It consists of a dissociation: a fact is forgotten when it cannot be awakened by an association, when it cannot enter into any series. In aphasia the thought no longer calls forth its appropriate sign, or at least its motor expression. Here however, the dissociation is more complete: there is dissociation not only between terms united by prior experience, but between elements so knit together that they form for consciousness a unity; to assert their relative independence of one another would seem to be mere hair-splitting were it not demonstrated by pathological facts. *

It is this perfect fusion of the thought, the sign (whether vocal or written) and the motor element which makes it so difficult to prove clearly and indisputably that sign-amnesia is mainly motor amnesia. As every state of consciousness tends to translate itself into motion; and as, according to Bain's happy phrase, to think is to restrain oneself from speech or action, it is impossible by analysis alone to draw clear lines of demonstration between these three elements. Still it appears to me that the memory of vocal and written signs which survives in the intelligent aphasic patient, represents fairly what has been called the inner speech, that minimum of ideation without which the mind would be on the way toward dementia; and consequently that the motor elements alone are suppressed in sign-amnesia.

On consulting what has been written by physicians who have studied the psychology of amnesia, and they are but few, I find that their doctrine differs in hardly any respect from that here set forth, save in terminology. "I have asked myself," says Trousseau, "whether [aphasia] is not simply a forgetting

* Authors have in late years carefully described under the name of "Word-blindness" (Wordblindheit) and "Word-deafness" (Worttaubheit) maladies that have long been confounded under the general designation of Aphasia. The patient is able to read and write; sight and hearing are well retained, and yet the words he reads or hears spoken have for him no meaning. For him they are simply optical or acoustic phenomena and are no longer signs. This is another and rarer form of dissociation. Kussmaul gives details. Op. cit. chap 2, 27.

of the instinctive and harmonic movements which we learned in early childhood, and which constitute articulate language; and whether, owing to this forgetting, the aphasic patient is not in the condition of a babe who is learning to babble his first few words, or of a deaf mute who, suddenly cured of his deafness, strives to imitate the speech of those whom he hears for the first time. The difference between the asphasic patient and the deaf mute then would be that the one has forgotten what he had learned and that the other has not yet learned at all." (Op. cit. p. 718.)

To the same effect Kussmaul: "If we consider memory as a general function of the nervous system, then, in order that the sounds be combined to make words, there must be both an acoustic and a motor memory. Thus the memory of words is a double memory, first a memory of words as far as they constitute a group of acoustic phenomena, and second a memory of words as motor images. (*Bewegungsbilder*)".

It has been justly remarked by Trousseau that aphasia is always reducible to loss of the memory either of vocal signs or of the means whereby we articulate words. W. Ogle also distinguishes two word-memories, one universally known, whereby we have consciousness of a word, and the other whereby we give expression to it." (Op. cit. p. 156.)

Is there any ground for affirming that the residua which correspond to an idea, those which correspond to its vocal or graphic sign and to the movements which translate both of these, have their seats side by side in the cortex? What anatomical inferences are to be drawn from the fact that one may lose memory of movements without losing memory of the inner signs of speech, without that of writing, or of writing without that of speech? Are the motor residua located in Broca's convolution, as some authors appear to hold? We can only state these questions; it is not for us to answer them. The relation between the sign and the idea, simple as it appears to the psychologist who follows the subjective method, is highly complex for the positive psychologist, who is helpless until anatomy and physiology have made further progress.

We have now to consider sign-aphasia under another aspect. We have studied it in itself, we will now study it in its evolution. I have endeavored to show that it affects especially the motor elements, and that this gives it its distinctive character: whether this be accepted or not does not concern what follows.

Sometimes the aphasia is of brief duration. Anon, it becomes chronic, and in seeing the patient after an interval of some years we notice no appreciable change. But there are cases where fresh apoplectic attacks increase the intensity of the malady, and then its course is progressive: such cases are of higher interest from our point of view.

There is a gradual breaking up, and the memory of signs declines little by little in a certain fixed order. Briefly stated, the order is, first, words, that is, rational speech; second, exclamatory phrases, interjections, what Max Müller calls "emotional language;" third, (in very rare cases), gestures.

We will examine in detail these three stages of dissolution; we shall thus have considered amnesia of signs in its totality.

1. The first stage is by far the most important, as it comprises the higher forms of language, those which are distinctively human, which express deliberate thought. Some physicians, even prior to the contemporaneous researches in aphasia, have remarked that all other things being equal, the memory of proper names is lost earlier than that of common nouns, and that the loss of common nouns precedes the loss of adjectives. This observation has since been confirmed by sundry investigations. "Substantives," says Kussmaul, in his latest work, "and in particular proper and concrete names (*Sachnamen*) are more readily lost than verbs, adjectives, conjunctions, and other parts of speech."* This fact has been noted only incidentally by medical men, and very few of them have inquired into its causes. In fact it possesses for them no clinical interest, while it is highly important for the psychologist.

We see at the first glance that amnesia progresses from the particular to the general. It first affects proper names, which are purely individual, then the names of things, next all substantives which are but adjectives in a special signification:† lastly, adjectives and verbs expressive of qualities, modes of being, acts and the like. The scholar mentioned by Gratiolet, who, having forgotten all proper names, was wont to say, "My associate who made such or such an invention," designated persons by their qualities. It has also been observed that idiots often have no memory save for adjectives. The idea of quality is the most stable, because it is the one first acquired, and because it is the basis of our most complex conceptions.

Now, since the particular is that which has least extension, and the general that which has most, we may say that the rapidity with which the memory of signs disappears is in inverse ratio to this extension; and since, *ceteris paribus*, a term has all the better chance of being repeated and fixed in the memory in proportion as it designates a greater number of objects, and all the less chance of being repeated and fixed in the memory in proportion as it designates only a few objects, we see that this law of dissolution rests in the last resort upon experimental conditions.

* "Die Störungen der Sprache," p. 164.

† The transformation of adjectives into substantives, one of the constant processes in the formation of languages, is still to be seen. Thus, we speak of a "special" meaning, "special" correspondent, a "brilliant," etc.

As a complement of these remarks, I will quote a passage from Kussmaul: "When the memory is failing, the more ancient an idea is, the more quickly is the term that expresses it lost. The reason of this is that our mental images of persons and things are more loosely connected with their names than are abstract notions, such as their condition, their relations, their qualities. We easily figure to ourselves persons and things without their names, because here the sensorial image is more important than that other image which is the sign, in other words their name. On the other hand, we do not acquire abstract ideas save by the aid of words which alone give to them a suitable form. Hence it is that verbs, adjectives, pronouns, and particularly adverbs, prepositions and conjunctions are more intimately associated with thoughts than are substantives. It may well be conceived that in the network of the cortical cells, many more phenomena of excitation and combination occur in the case of an abstract idea than in that of a concrete one, and that consequently the organic connections that attach an abstract idea to its sign are far more numerous than in the case of a concrete idea" (*op. cit.* p. 164). Translated into psychological language, this last phrase amounts to what we have already said, namely, that the stability of the sign is as its organization, *i. e.*, as the number of experiences repeated and registered.

The science of language also furnishes us with very valuable data. At the risk of wearying the reader by a superabundance of proof, I must take note of these. As was to have been expected, the evolution of language has followed an order inverse to that of the loss of language in aphasia.

Before we cite in favor of our law the historic development of languages, it might seem natural that we should ascertain the process of language development in the individual. That, however, is impossible. When we are learning to speak, our language is given to us ready-made. Though the babe, as has been well observed by Mr. Taine, "learns a language already made, as the true musician learns counterpoint, or the true poet prosody; in other words, as an original genius," still in reality he creates nothing at all. We must therefore confine ourselves to the historical evolution of language.

It is certain that the Indo-European languages are descended from a certain number of roots, and that these roots were of two kinds, namely, verb or predicative roots, and pronominal or demonstrative roots. The former, comprising verbs, adjectives and substantives are, says Whitney, signs indicating acts or qualities. The others, whence come the pronoun and the adverb (the preposition and conjunction are of secondary formation), are few in number, and denoted relative position. The original form of language signs therefore is the attribution of qualities. Then

the verb and the adjective became discriminated. "Nouns are derived from verbs through the participles, which are only adjectives whose derivation from verbs is not yet obliterated."* As for the transformation of common nouns into proper nouns, that admits of no question. Does not the natural evolution of language explain the stages of its dissolution in aphasia, in so far as we may compare a spontaneous creation with the decay of a language artificially acquired?

2. In setting forth in its most general form the law of the regression of memory, we have seen that the memory of feelings is effaced later than the memory of ideas. Logic leads us to infer that in the case we are considering—progressive sign-amnesia—the language of the emotions must disappear later than the language of the reason. Facts fully confirm this deduction.

The most careful observers—as Broca, Trousseau, Hughlings Jackson, Broadbent—have noted a great number of cases where aphasic patients entirely deprived of speech, incapable of articulating spontaneously a single word, are able to utter not only interjections, but also complete phrases, brief habitual sentences expressive of anger or vexation, or of pain for their privation. One of the most persistent forms of such emotional language is that of profanity.

We have said that generally that which is of recent formation dies out first, whatever is of old formation disappears last. The remark is confirmed by what we see here: the language of the emotions is formed before that of ideas; it disappears later. So, too, the complex disappears earlier than the simple: and rational language, compared with the language of the emotions, is exceedingly complex.

3. All the foregoing remarks are applicable to gestures. That form of language—and it is the most natural of all—is, like the interjection, only a reflex mode of expression. It appears in the babe long before articulate language. Among some savage tribes stricken with arrest of development, gestures play as important a part as words. This inborn form of language is seldom lost. "Cases of aphasia in which disorders of the mimic faculty occur are always," says Kussmaul, "of an exceedingly complex character. In such cases the patients sometimes are conscious that they err in the use of gestures, sometimes again they are not." (*Op. cit.* p. 160).

Hughlings Jackson, who has carefully studied this subject, notes that some aphasic subjects can neither laugh nor smile, nor cry except in case of extreme emotion. Further he has noted that some patients express affirmation or negation by purely chance gestures: one of them, who had still at his command a few interjections and a few gest-

* Baudry, "La Science du Langage," p. 16. For fuller details consult the works of Max Müller and Whitney.

ures, employed them in a contrary sense, in an unintelligible way.

Trousseau gives a very remarkable instance of pure motor amnesia affecting gestures: "I would raise both hands and move my fingers, as though playing the clarinet, and tell the patient to do the same. He forthwith would perform these movements with perfect precision. 'You see,' I would say, 'I am acting as though I played the clarinet,' to which he would signify assent. After a few minutes I would ask him to execute the movement again. He would deliberate, but in most instances it was impossible for him to perform this very simple piece of mimicry."

Thus, then, we have seen that sign-amnesia proceeds from proper nouns to common, thence to adjectives and verbs, and finally affects the language of the emotions, and gesture. This destructive process does not advance at random, but follows a fixed order, from the less organized to the better organized, from the complex to the simple, from the less to the more automatic. What was said above when we laid down the general law of the reversion of memory might be repeated here, and it is one evidence of its correctness that it is verified in sign-amnesia, the most important, the most systematic and the best-known form of partial amnesia.

We may now proceed to give a counter-proof. When the amnesia of signs is complete and memory is gradually coming back, does this process follow an order inverse to that of the disappearance of memory? Instances of recovery are rare. I find one case, however, mentioned by Dr. Grasset, where a man was seized with "entire disability to express his thoughts whether in words, or in writing, or by gestures. Some days later his power of making himself understood by gestures was seen to return little by little—then successively the power of expression by means of words, and finally by means of writing.* It is highly probable that other instances might be found were the attention of observers directed to this point.

CHAPTER IV.

EXALTATION OF MEMORY, OR HYPERMNESIA.

General excitation—Partial excitation—Return of lost memories—Return of forgotten languages—Reduction of this fact to the law of regression—Case of false memory—Examples and a suggested explanation.

Hitherto, our pathological study has been limited to cases of impairment of memory. But there are cases of a very different kind,

where that which seemed to have been destroyed revives and faint recollections recover their original intensity.

Is this exaltation of memory, called by physicians hypermnesia, a morbid state? It is at least an anomaly; and since it is always associated with some organic trouble or some singular and unusual condition, it unquestionably belongs to our subject. It is a less instructive object of study than amnesia, but it must not on that account be omitted. Besides, as we shall see, it teaches us something about the persistence of recollections.

Excitations of memory are either general or partial.

I.

General excitation of memory is not easy to determine, the degree of excitation being relative. We should have to compare memory with itself in the same individual. Since the power of this faculty differs widely between different persons, there is no common measure; the amnesia of one person may be the hypermnesia of another. It is in fact a change of *tone* occurring in the memory, such as may occur in any other form of psychic activity; whether thought, imagination, or sensibility. Again, when we say that the excitation is general, that is merely a probable induction. As memory is subject to the condition of consciousness, and as consciousness exists only in the form of a series, all that we can prove is simply that during a longer or shorter period a multitude of recollections arise on all sides.

General excitation of memory seems to depend entirely on physiological causes, and in particular upon the rapidity of the cerebral circulation. Hence, it is of frequent occurrence in high fevers. It also occurs in cases of mania, ecstasy, hypnotism, occasionally in hysteria, and in the incubation-period of some brain diseases.

Besides these strictly pathological cases, there are others of a more unusual character which probably depend on the same cause. Thus, there are narratives of drowning persons saved from imminent death, all of which agree on this point, viz., that "when asphyxia began, the drowning person seemed to review in an instant the whole of his past life with all its little details." One man affirmed that "every instant of his former life seemed to glance across his recollection in a retrograde succession, not in mere outline, but the picture being filled with every minute and collateral feature forming a kind of panoramic picture of his entire existence, each act of it accompanied by a sense of right and wrong."

Under analogous circumstances, "a man of remarkably clear head was crossing a railway in the country when an express train, at full speed, appeared closely approaching him. He had just time to throw himself down in the center of the road between the two lines

* "Revue des Sciences Médicales," 1873, vol. ii, p. 684.

of rails, and as the train passed over him, the sentiment of impending danger to his very existence brought vividly to his recollection every incident of his former life in such an array as that which is suggested by the promised opening of 'the great book at the last great day.' *"

Even when we make allowance for exaggeration, these facts reveal to us a superactivity of memory or which we can have no idea in the normal state.

I will quote one more instance due to opium intoxication, and I beg the reader to note how this confirms the explanation already given of the mechanism of recollection. Says Thos. De Quincey: "I sometimes seemed to have lived for seventy or one hundred years in one night. * * * The minutest details of childhood, or forgotten scenes of later years, were often revived. I could not be said to recollect them, for if I had been told of them when waking I should not have been able to acknowledge them as parts of my past experience. But placed as they were before me, in dreams like intuitions, and clothed in all their evanescent circumstances and accompanying feelings, I *recognized* them instantaneously." †

All these general excitations of memory are transitory, never outliving the causes that produce them. Is there a permanent form of hypermnnesia? If the term may be used in rather wide sense, we might apply it to the curious development of memory that follows certain injuries. Upon this point we find in old authors stories that are now controverted; instance the cases of Pope Clement VI., Mabillon, and others. There is no reason to question these stories, for modern observers, Romberg among them, have noticed a remarkable permanent development of memory as the result of brain concussion, smallpox, etc. The mechanism of this change being inscrutable, we need not dwell upon it.

II.

Partial excitations of memory are, by their very nature, definitely limited. When the habitual tone of the memory is as a whole preserved, whatever goes beyond that is easily ascertained. Such hypermnnesia is the necessary correlative of partial amnesia; it proves again and under a new form that memory is made up of *memories*.

We find nothing resembling a law in the production of partial hypermnnesia. It manifests itself in isolated facts, that is to say as the result of a concurrence of conditions which elude observation. Why is one group of cells forming one particular dynamic association affected rather than another? No reason can be given, whether physiological or psychological. The only instances in which there is any appearance of law are those to

be mentioned further on, where several languages come back successively to the memory.

Partial excitation most usually results from morbid causes: these have been already indicated. But sometimes it occurs in the state of health. Here are some examples: "A lady in the last stages of a chronic disease was carried from London to a lodging in the country; there her infant daughter was taken to visit her, and after a short interview carried back to town. The lady died a few days after, and the daughter grew up without any recollection of her mother till she was of mature age. At this time she happened to be taken into the room in which her mother died, without knowing it to have been so; she started on entering it, and when a friend who was along with her asked the cause of her agitation, she replied: 'I have a distinct impression of having been in this room before, and that a lady who lay in that corner and seemed very ill, leaned over me, and wept.'"

A clergyman, of marked artistic temperament (this is worthy of note), went with a party of friends to visit a castle in Sussex, which he had no recollection of having ever seen before. "As he approached the gateway, he became conscious of a very vivid impression of having seen it before; and he 'seemed to himself to see' not only the gateway itself, but donkeys beneath the arch, and people on the top of it. His conviction that he *must* have visited the castle on some former occasion made him inquire from his mother if she could throw any light on the matter. She at once informed him that, being in that part of the country when he was about *eighteen months* old, she had gone over with a large party and taken him in the pannier of a donkey; that the elders of the party, having brought lunch with them, had eaten it on the roof of the gateway where they would have been seen from below, while he had been left on the ground with the attendants and donkeys." †

The mechanism of remembering in these two instances leaves no room for question: it is a revival of memories produced by nearness in space. They simply present in a more striking and less accustomed way that which we see every moment of our lives. Who is there that, in order to regain a recollection that he has for the moment lost, has not gone back to the place where the thought first presented itself, thus placing himself as nearly as possible in the same material situation, and so bringing back the recollection in an instant?

As for hypermnnesia due to any morbid cause, I will cite only one instance, which will serve as a type: "A boy, at the age of four, received a fracture of the skull, for

* For these cases and others of like nature, see Winslow, *op. cit.*, p. 333, *et seq.*

† "English Opium-Eater."

* Abercrombie, "Essay on the Intellectual Powers," p. 120.

† Carpenter, *loc. cit.*, p. 421.

which he underwent the operation of trepan. He was at the time in a state of perfect stupor, and after his recovery retained no recollection either of the accident or of the operation. At the age of fifteen, during the delirium of a fever, he gave his mother a correct description of the operation, and the persons who were present at it, with their dress and other minute particulars. He had never been observed to allude to it before, and no means were known by which he could have acquired the circumstances which he mentioned.*

The recovery of languages that have been quite forgotten, may well engage our attention for a moment. The case recorded by Coleridge is so well known that I shall not speak of it. There are many other cases of the same kind to be found in the works of Abercrombie, Hamilton and Carpenter. The anæsthetic sleep produced by chloroform or ether may produce the same effects as febrile excitation. "An aged forester had lived in early life on the Polish frontier and there had spoken Polish almost exclusively. Later he lived only in German districts. His children said that for thirty or forty years he had neither heard nor spoken a word of Polish. During two hours of anæsthesia, he spoke, uttered prayers, and sung only in Polish.†

Still more curious than the recovery of one language is the retrogressive return of many languages. Unfortunately the authors who have written about this fact, report it simply as a matter of curious interest, without stating all the particulars needed for its interpretation.

The most clearly defined case is the one observed by Dr. Rush, of Philadelphia, and recorded in his "Medical Inquiries and Observations upon Diseases of the Mind." "Dr. Scandella, an ingenious Italian who visited this country a few years ago, was master of the Italian, French and English languages. In the beginning of the yellow fever, which terminated his life, he spoke French only; but on the day of his death he spoke only in the language of his native country."

The same author writes in rather confused terms of a woman subject to attacks of temporary insanity. First she spoke in broken Italian; at the crisis of her disorder, in French; when the fever was abating, in German; when she was beginning to convalesce, she returned to English, her mother tongue.

Quitting these cases of regression through many languages, and turning our attention to simpler cases, we find an abundance of indisputable testimony. A Frenchman living in England and speaking English fluently, received a blow on the head. During his illness, he was able to answer questions only in French.

But there is no case more instructive than

one recorded by Dr. Rush. I have it, he says in substance, from a German Lutheran minister residing in America, and who had in his congregation a considerable number of Germans and Swedes, that when at the point of death they nearly all utter their prayers in their mother tongue. In visiting old Swedes upon their death-beds he was "much struck in hearing some of them pray in the Swedish language, who, he was sure had not spoken it for fifty or sixty years before, and who had probably forgotten it."

Winslow too notes how Catholics converted to Protestantism, during the delirium which precedes death, pray almost exclusively in the Roman formulas.*

This return of forgotten languages and formulas, properly understood, is simply a special instance of the law of regression. In consequence of a morbid action that usually ends in death, the most recent memory-deposits are first destroyed, and the work of destruction proceeding by degrees to the earliest acquisitions which are also the most firmly grounded, gives to them a momentary activity and then effaces them forever. Hypermnæsia therefore is simply the result of conditions entirely negative; regression results, not from a normal return to consciousness, but from the suppression of more vivid, more intense states. These revived memories are like a feeble voice that can make itself heard only when more powerful voices are stilled. These acquisitions and habits of childhood or of youth come into the foreground, not because there is anything urging them to the front, but because there is nothing any longer to overlie them. Reviviscences of this kind are, strictly speaking, only a reversion back to conditions of existence that seemed to have vanished forever, but which the work of demolition brings to light again. I refrain however from the reflections that these facts so naturally suggest, and leave them for the moralist. He will be able to point out for instance how certain religious reversions occurring in the last moments of life, and which make so much noise in the world of polemics, are but the necessary effect of irremediable dissolution.

Independently of this unexpected confirmation of our law of regression, the outcome of our study of hypermnæsia is a knowledge of the surprising persistence of those latent conditions of recollection which have been called "residua." But for these disorders of memory, we should not have suspected their existence, for consciousness, of itself, can only affirm the conservation of the states which constitute our everyday life and of certain other states which the will holds in dependence upon itself, because habit has fixed them.

Are we to infer from the fact of these reviviscences that nothing is lost from the

* Abercrombie, *op. cit.*, p. 149.

† Duval, art. Hypnotisme, in "Nouveau Dict. de Médecine," p. 144.

Op. cit. p. 253; see also p. 265, 266, 305.

memory? That whatever is once registered therein is indestructible, and that even the most transient impression may at one time or another be revived. Many authors, Maury in particular, have contributed striking examples in support of this opinion. But should any one maintain that, even in the absence of morbid causes, some residua disappear, there is nothing known whereby he might be peremptorily refuted. Possibly some cellular modifications and some dynamic associations are too instable to last. Still it may be said that persistence, if not the rule without exceptions, is nevertheless the rule: it embraces the great majority of cases.

Of the mode in which these old-time recollections are preserved and reproduced, we know nothing, but I may point out how this might take place on the hypothesis set forth in the present work.

If we accept as the material substratum of our recollections cell modifications and dynamic associations, any memory, however burdened it may be with impressions, may keep them all. For though cell modifications are limited in number, dynamic associations are innumerable. We may suppose that the old associations reappear when the new ones, disorganized for a time or permanently, leave the field clear for them. The number of possible reviviscences being much reduced, the chances are proportionately increased for the return of the more stable, *i. e.*, the oldest associations. But I will not dwell on an hypothesis that cannot be verified. I desire to confine my observations to that which can be ascertained.

We cannot refer to any of the preceding morbid types one illusion of a singular character, one besides that is of rare occurrence or seldom observed. Three cases of this illusion only are on record, and no specific name has been offered to designate it. Wigan has called it, inaptly enough, double-consciousness, and Sander defines it to be an illusion of memory (*Erringerungstauschung*). Other authors have given it the name of false memory, and this seems to me to be preferable. It consists in a belief that a state of consciousness that in reality is new was experienced before, so that when it first occurs it is thought to be a repetition.

Wigan in his well-known work, "Duality of the Mind," states that while he was attending the obsequies of the Princess Charlotte in Windsor Chapel, of a sudden the feeling came upon him that before he had witnessed the same spectacle. The illusion was transitory, but we shall see cases in which it more lasting. Lewes justly classes this phenomenon with others of more frequent occurrence. While journeying in regions never before visited by us, a turn of the road or a bend in the river brings us in sight of some landscape that we have seen before; meeting a person for the first time, we *feel* that we must have seen him elsewhere; on

reading in a book a passage that certainly we never read before, we feel that the thoughts have once been in our minds.

This illusion is easily explained. The new impression evokes from the past similar impressions, which, though indistinct, confused, evanescent, still suffice to give to the new state of consciousness the appearance of being a repetition. There is a ground of resemblance quickly perceived between the two states of consciousness which leads us to identify them. It is an error, but only a partial one, for there is in reality in our past something that resembles a prior experience of this present impression. While this explanation may do for very simple cases, there are others to which it will not apply.

A patient, says Sander, on hearing of the death of one he had known, was seized with an indefinable terror, because it seemed to him that he had already had the impression. "It was as though, some time ago, while he was lying on this very bed, X came and told me that Müller was dead. I replied, 'Müller died some time since; he cannot die twice.'"

Dr. Arnold Pick relates the most perfect instance of false memory I know of, the disorder assuming an almost chronic form. An educated man who reasoned clearly about his malady, and who wrote a description of it, was, at about the age of thirty-two, seized with a peculiar mental disorder. If he attended a festival, or visited any place, or fell in with any one, the occurrence, with all its circumstances, seemed to him so familiar, that he firmly believed that he had already had the self-same impressions, in the company of the same persons, under the same skies, the same weather, etc. If he did a piece of work, it seemed to him that he had done the very same work before under the same circumstances. This feeling occurred to him the same day, at the end of a few minutes, or a few hours, sometimes on the next day, but always with perfect distinctness.*

In false memory there is an anomalous condition of the mental mechanism that eludes observation, and which it is difficult to understand in the healthy state. The patient, even though he were a good observer, could only analyze it by ceasing to be under the illusion. Still I think these instances show that the impression received is reproduced in the form of a sensorial image—in physiological terms, there is a repetition of the primary cerebral process. This is nothing extraordinary, it is what occurs in every recollection that is not called forth by the actual presence of its object. The difficulty is to say why this image, appearing a minute, an hour, a day, subsequent to the real state of consciousness, gives to the latter the appearance of being a repetition. We may suppose the mechanism of recollection, of localization in

* "Archiv für Psychiatric," 1896.

time to be working retrogressively. I venture to offer the following explanation :

The image thus formed, as has been said, is highly intense—*of the nature of an hallucination*. Consequently the real impression is thrown into the background, bearing the less distinct character of a recollection. It is localized in the past, erroneously if you consider the facts objectively, rightly if you consider them subjectively. This hallucinational state, though very vivid, does not, in fact, efface the real impression ; but as it is produced by it and becomes detached from it, it appears like a subsequent experience. It takes the place of the real impression, appears the more recent of the two, and in fact is the more recent. For us who look at the thing from without and in the light of what has taken place outside of the mind of the subject, it is not true that the impression has been received twice ; but from the point of view of the subject himself, who judges according to what consciousness tells him, it is true that the impression has been received twice, and within those limits his asseveration is incontestable.

In support of this explanation I may add that false memory is nearly always associated with mental disorder. The patient spoken of by Pick was subject to one form of insanity—he supposed himself to be the victim of persecution. Hence the formation of hallucinational images is quite natural. Still I do not pretend that my explanation is the only possible one. The case being so very uncommon, further and more careful observation is requisite.

CHAPTER V.

CONCLUSION.

Relations between the retention of perceptions and nutrition, between the reproduction of recollections and the general and local circulation—Influence of the quantity and quality of the blood—Examples—The law of regression connected with a physiological principle and a psychological principle—Recapitulation.

I.

So far we have been describing the diseases of memory and seeking the law which governs them. Before we conclude we must say a word as to the causes, of course we mean immediate, organic causes. But even reduced to these terms the etiology of disorders of memory is very obscure, and very little is clearly ascertained with regard to it.

Memory consists in retaining and reproducing: retention seems to depend above all on nutrition; reproduction on the general or the local circulation.

I. Retention, which plays the more im-

portant part since without its reproduction is impossible, presupposes a primary condition which can only be vaguely defined as a normal constitution of the brain. As we have seen, idiots suffer from congenital amnesia, from innate inability to fix impressions in the memory. This primary condition is a postulate, not simply a condition of memory, but the necessary condition of the existence of memory.

This normal condition of the brain being granted, it is not enough that impressions be received, they must be fixed, organically registered, incrustated, so to speak: they must become a permanent modification of the brain; the modifications impressed upon the nerve-cells and nerve-filaments, and the dynamic associations between these elements must be made stable. This result can be produced only by nutrition. The brain, and particularly the gray matter, receives an enormous volume of blood. In no other part of the body is the nutritive function so active or so rapid. We know not the inner mechanism of this function. The minutest histological research is unable to trace the arrangements and rearrangements of the molecules. We know only the effects—all beside is but induction. But all sorts of facts go to show the close connection between nutrition and memory.

It is matter of every-day observation that children learn with wonderful facility, and that anything, as languages, which calls only for memory, is readily learned by them. We know, furthermore, that habits—that is to say one form of memory—are far more easily formed in childhood, in youth, than in maturity. At that period of life, so great is the activity of the nutritive process that new connections are rapidly formed. In the aged, on the contrary, a rapid effacement of new impressions coincides with a considerable decline of this activity.

That which is too quickly learned does not endure. When we say that a thing is "assimilated," we use no metaphor. I shall not dwell upon a truth that every one is ever repeating, little suspecting that this psychic fact has an organic cause. To fix recollections requires time, because nutrition does not accomplish its work instantaneously: the molecular movement constituting nutrition must proceed in one constant direction, and this end is served by the periodic renewal of the same impression.*

*"A distinguished theatrical performer," says Abercrombie, "in consequence of the sudden illness of another actor, had occasion to prepare himself, on very short notice, for a part which was entirely new to him; and the part was long and rather difficult. He acquired it in a very short time, and went through it with perfect accuracy, but immediately after the performance forgot every word of it. Characters which he had acquired in a more deliberate manner he never forgets, but can perform them at any time without a moment's preparation; but in regard to the character now mentioned, there was the further and very singular fact that, though he has repeatedly

Fatigue in every shape is fatal to memory. The impressions received under such conditions are not fixed, and the reproduction of them is very laborious and often impossible. Now, fatigue is regarded as a state wherein, owing to the over activity of an organ, the nutrition suffers and halts. When the normal conditions are restored, memory comes back again. The case already quoted from Sir Henry Holland is decisive upon this point.

We have seen that in cases of temporary amnesia, caused by concussion of the brain, the amnesia is always retroactive, extending back to a period of greater or less duration, anterior to the accident. This rule is almost without exception. Most physiologists who have studied this phenomenon, refer it to defective nutrition; the organic registration, which consists in a nutritive modification of the cerebral matter, has not had time to take place.

Finally it is to be noted that the gravest form of disease of memory, namely the progressive amnesia of the demented, of the aged, and of general paralytics, is produced by a steadily increasing atrophy of the nerve-elements. The tubes and the cells undergo a process of degenerescence, and the latter eventually disappear, leaving behind an undifferentiated mass of matter.

These physiological and psychological facts all show that there exists between nutrition and retention the relation of cause and effect. There is exact coincidence between their periods of rise and fall. Variations short or long in the one are repeated in the other. If the one be active, or moderate, or languishing, so is the other. Hence the retention of recollections must not be regarded metaphysically, and as a "state of the soul" subsisting no one knows where, but as an acquired state of the cerebral organ implying the possibility of states of consciousness whenever their conditions of existence are present.

The extreme rapidity of nutritive changes in the brain, though at first it might appear to cause instability, in fact explains the fixation of recollections. "The waste following activity is restored by nutrition, and a trace or residuum remains embodied in the constitution of the nervous center, becoming more complete and distinct with each succeeding repetition of the impression; an acquired nature is grafted on the original nature of the cell by virtue of its plastic power." *

performed it since that time, he has been obliged each time to prepare it anew, and has never acquired in regard to it that facility which is familiar to him in other instances. When questioned respecting the mental process which he employed the first time he performed this part, he says that he lost sight entirely of the audience, and seemed to have nothing before him but the pages of the book from which he had learned it; and that if anything had occurred to interrupt the illusion, he should have stopped instantly." (*Op. cit.*, p. 103.)

* Maudsley, "Physiol. and Pathol. of the Mind".

We here touch the ultimate cause of memory biologically considered; it is an impregnation. It is therefore not surprising that an eminent English surgeon, in treating of the indelible impression made by infectious diseases on living tissues, should have indited the following passage, which seems made to our hand: "It is asked," says Sir James Paget, "how can the brain be the organ of memory when you suppose its substance to be ever changing? or how is it that your assumed nutritive change of all the particles of the brain is not as destructive of all memory and knowledge of sensuous things as the sudden destruction by some great injury is? The answer is, because of the exactness of assimilation accomplished in the formative process; the effect once produced by an impression on the brain, whether in perception or in intellectual act, is fixed and there retained; because the part, be it what it may, which has been thereby changed, is exactly represented in the part which, in the course of nutrition, succeeds to it." * Paradoxical as the connection between an infectious disease and memory may seem, it is nevertheless rigorously exact, from the biological point of view.

II. In a general way the reproduction of recollections seems to depend on the state of the circulation. This point is much more obscure than the preceding, and the data concerning it are very incomplete. One difficulty arises out of the rapidity with which the phenomena succeed one another, and their continual changes. Another difficulty is due to their complexity. For reproduction does not depend on the general circulation alone, but also on the special circulation of the brain, and probably there are in the latter, too, local variations that may exert a strong influence. Nor is that all. We have, further, to take into account the quality no less than the quantity of the blood.

It is impossible to determine, even roughly, the part played by each of these factors in the mechanism of reproduction. We must be content with showing that circulation and reproduction present correlative variations. The main facts going to confirm this view are as follows:

Fever in its several degrees is accompanied by cerebral over-activity, and in this memory largely shares. We have already seen to what a degree of excitation it may attain. We know that in fever the rapidity of the circulation is excessive, that the constitution of the blood is changed, that it is loaded with elements resulting from too accelerated a process of combustion. Here we see a variation in quality and in quantity, which finds expression in hypermnnesia.

Even when no fever exists, "impressions of trivial things, in which no particular interest was taken, often survive in memory when

* "Lecture on Surgical Pathology."

impressions of much more important or imposing things fade away; and in considering the circumstances, it will frequently be found that such impressions were received when the energies were high—when exercise, or pleasure, or both, had greatly raised the action of the heart. That at times, when strong emotion has excited the circulation to an exceptional degree, the clustered sensations yielded by surrounding objects are revivable with great clearness, often throughout life, is a fact noticed by writers of fiction as a trait of human nature."*

Note again how easy and how rapid reproduction is in that period of life when the blood flows swift and strong, but how slow and labored, when age slows the circulation. Also how in the aged the constitution of the blood is changed, being less rich in globules and in albumen.

In persons debilitated by protracted disease, memory grows weak with the circulation. "Highly nervous subjects, in whom the action of the heart is greatly lowered, habitually complain of loss of memory and inability to think—symptoms which diminish as fast as the natural rate of circulation is regained."†

There is exaltation of memory whenever the circulation has been modified by stimulants, as hasheesh, opium, etc., which excite the nervous system first, and then depress it. Other therapeutic agents produce the opposite effect; for instance, bromide of potassium, the action of which is sedative, hypnotic, retards the circulation, when taken in strong doses. A certain preacher had to give up the use of the bromide, having lost nearly all power of memory. It returned when he ceased to take the medicine.

The general conclusion to be drawn from all these facts is that the normal exercise of memory presupposes an active state of the circulation and a constitution of the blood rich in the materials necessary for integration and disintegration. When this activity becomes excessive there is a tendency to morbid excitation; when it decreases, there is a tendency to amnesia. More definite conclusions would have to rest on pure hypothesis. Why is it that one category of recollections rather than another is revived or effaced? We know not. There is in every case of amnesia and of hypermnesia so much that cannot be foreseen that it were vain to attempt an explanation. Probably it is flitting organic modifications, causes infinitesimally small, that make one series of impressions more easy or more difficult of recall than others. Some physiologists are of the opinion that limited and temporary eclipses of memory are due to local, transitory modifications of the caliber of arteries, under the action of the vaso-motor nerves; and have

cited as proof of this the fact that the return of memory is sudden, that it is caused by emotion and that the emotions have a special influence upon the vaso-motor system.

In cases of complete loss of memory, of which we have cited many, return depends on the circulation and nutrition. If it is sudden, and it but rarely is, the more probable hypothesis is that of an arrest of function, a state of inhibition which is suddenly terminated: this problem is one of the most intricate in nerve physiology.

If the return is the result of reeducation—and this is more usual—nutrition appears to play the principal part. The rapidity with which the patient learns again shows that all was not lost. The cells may have been atrophied, but if their nuclei (generally regarded as the sources from which they are reproduced) give rise to other cells, then the bases of memory are by that very fact re-established: the new cells resemble the parent cells in virtue of the tendency of all organisms to maintain its type, and of all acquired modifications to become transmitted modifications: in this case, memory is only a form of heredity.

II.

To sum up, memory is a general function of the nervous system. Its basis is the property possessed by the nerve-elements of retaining a received modification and of forming associations. These associations, the result of experience, we have called dynamic, to distinguish them from those which are natural or anatomical. Retention is assured by nutrition, which is ever making the modifications and associations stable, because it is ever renewing the modified nerve-substance. The power of reproduction seems to depend above all on the circulation.

Retention and reproduction: thus does all that is essential to memory depend on the fundamental conditions of life. The rest—consciousness, exact localization in the past is only a perfectionment. Psychic memory is only the highest and most complex form of memory. To restrict oneself to that, as most psychologists do, is to condemn oneself in advance to wrestle with mere abstractions.

These preliminaries settled, we have classified and described the diseases of memory; and as a precise observation is always of far more value than a general description, being more instructive and more suggestive, we have offered clear and authentic instances of each morbid type.

Having traversed a multitude of facts, we have pointed out their principal results, viz., first the necessity of resolving memory into *memories*, the mutual independence of which is clearly proved by pathological cases. Then we have shown that the destruction of memory proceeds according to a *law*. Setting aside secondary disorders, those of brief

* Herbert Spencer, "Principles of Psychology,"

I, p. 235.

† *Ib.*, p. 237.

duration and which are less instructive, and studying those whose evolution is normal, we have shown that:

In *general* dissolution of memory, the loss of recollections, follows an invariable order, namely: first, recent events; next, ideas in general; then, feelings; lastly, acts.

In *partial* dissolution of the most usual type, namely, sign-amnesia, the loss of recollection again proceeds according to an invariable order, viz., proper names, common nouns, adjectives and verbs, interjections, gestures.

The order is the same in both, namely, there is a regression from the more recent to the older, from the complex to the simple, from the voluntary to the automatic, from the less to the more organized.

The exactitude of this *law of regression* is proved by the very rare instances in which progressive dissolution of memory is followed

by recovery; the recollections in that case come back in the inverse order of their disappearance.

By the aid of this law of regression we have been enabled to explain the extraordinary reviviscence of certain recollections as a reversion of the mind back to states that seemed to have been effaced forever.

We have connected our law with the physiological principle that degenerescence first affects that which is of most recent formation; and with the psychological principle, that the complex disappears before the simple, because it is less often repeated in experience.

Finally, our pathological study has led us to the conclusion that memory consists of an organization process having varying degrees of perfection between these two extreme limits—the new state, the organic registration.

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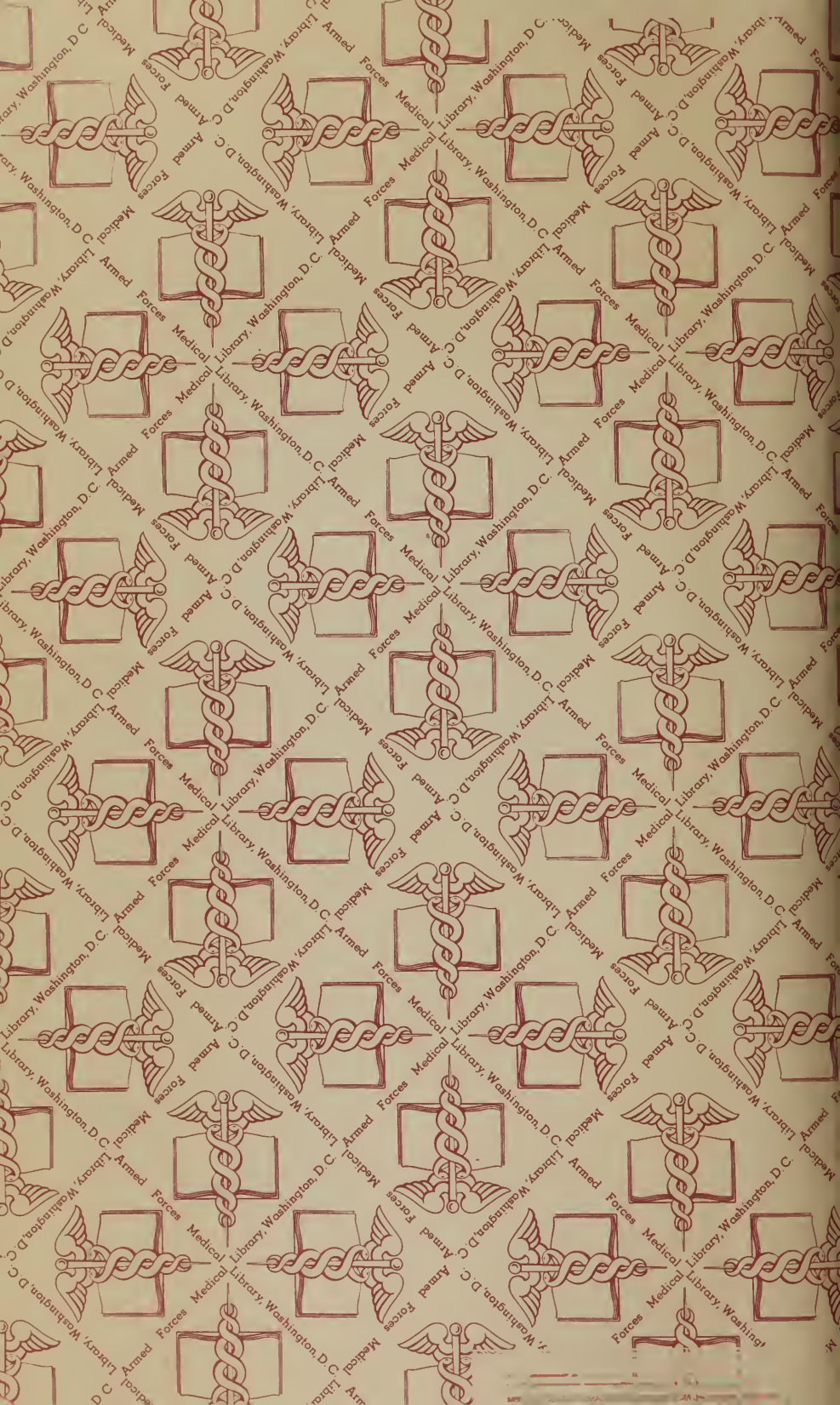
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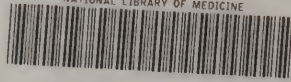
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